THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXIII. No. 1619.] LONDON, MAY 22, 1894. [46TH YEAR. PRICE 6d.

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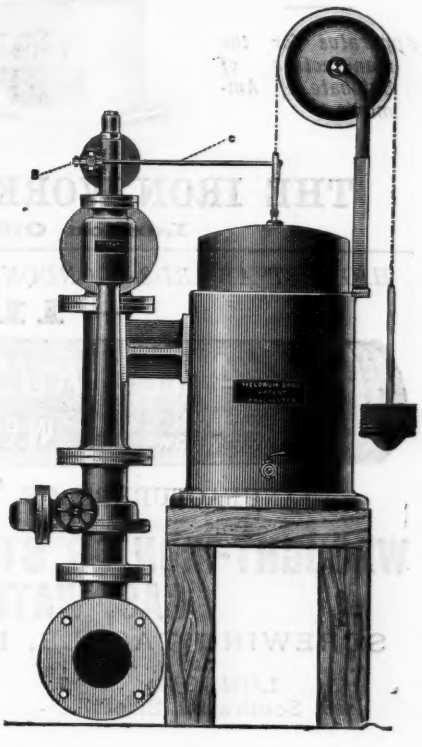

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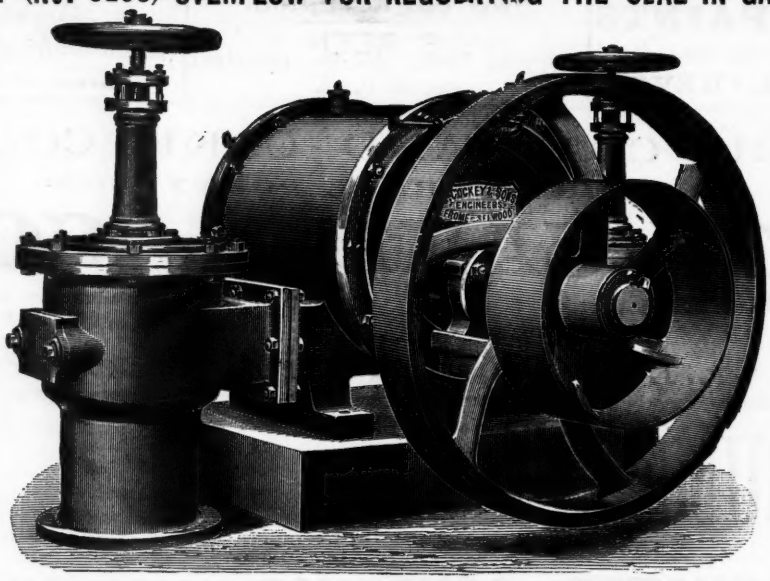

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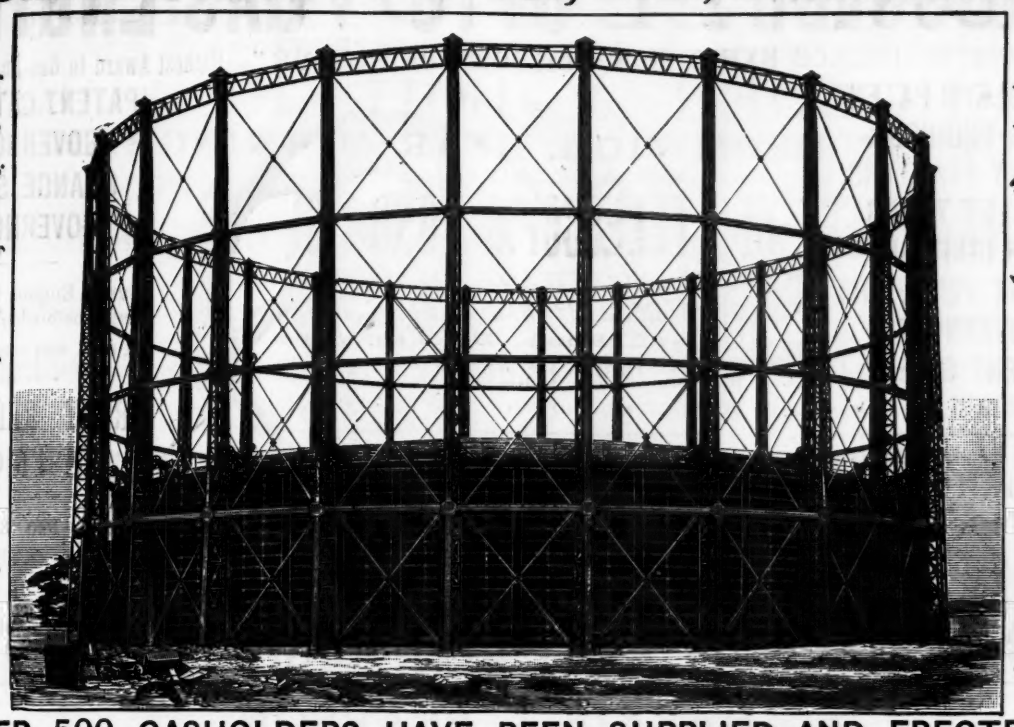

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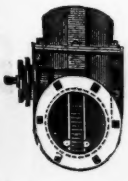

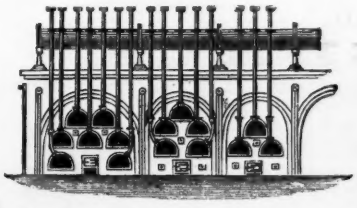

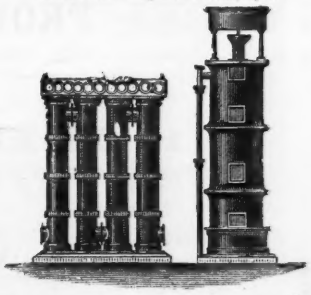

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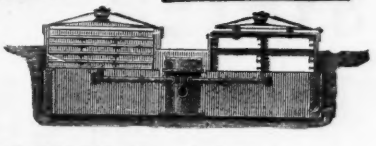

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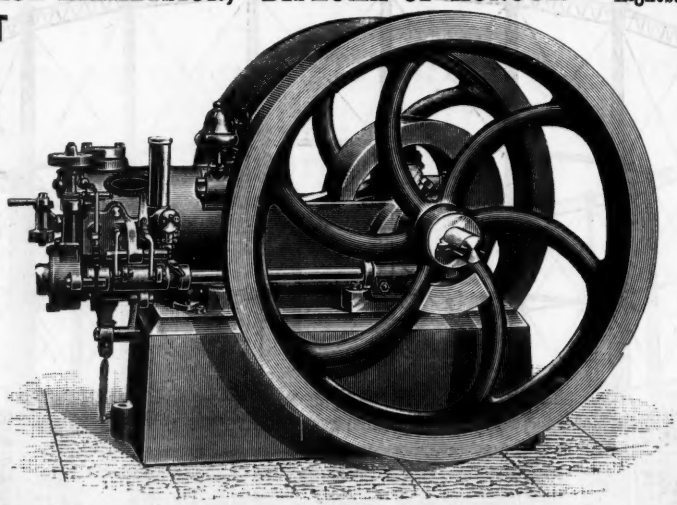

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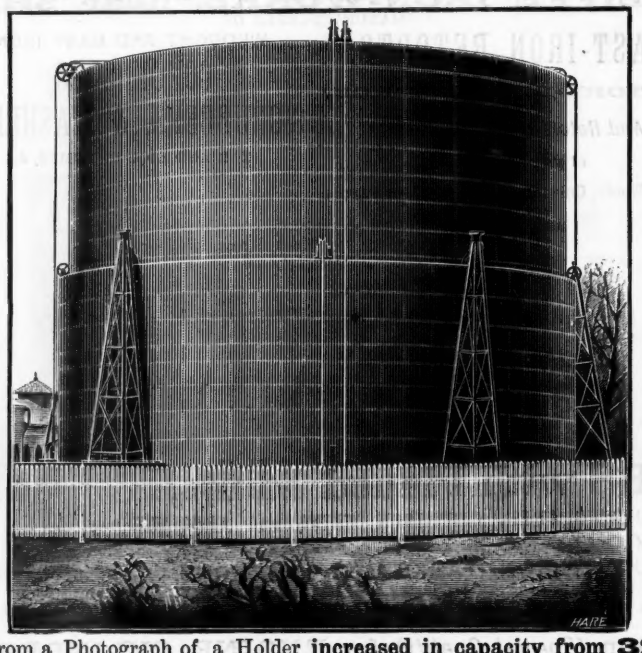

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Opinion of
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I am, yours truly,
THOS. NEWBIGGING, M.Inst.C.E.

Opinion of
J. HEPWORTH, Esq.,
M.Inst.C.E.,

Gas-Works, Carlisle,
Jan. 13, 1894.

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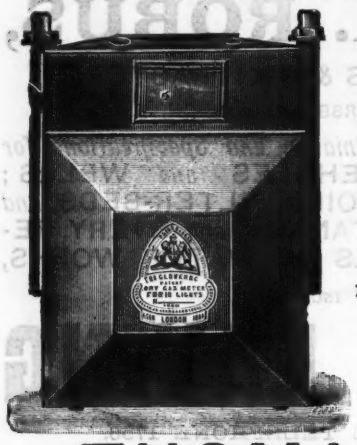

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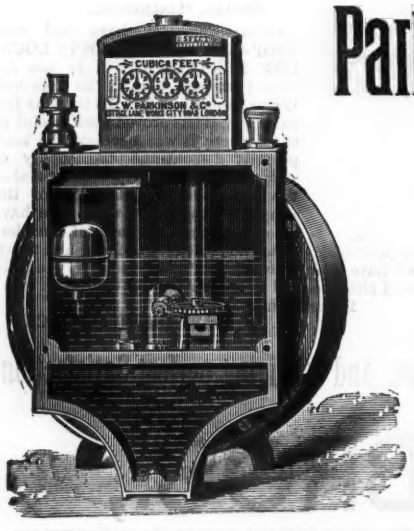

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MAY 22, 1894.

The Law of Untrustworthy Prepayment Meters.

A NOTEWORTHY point of law has cropped up at Kendal in connection with the automatic prepayment gas-meter, and was disposed of by the County Court Judge after a fashion that calls for some remark. The Kendal Gas and Water Company took proceedings against one of their customers for the recovery of an amount of £1 12s. 6d. for gas consumed. It appeared, from the statement of the plaintiffs' case, that the defendant had a shilling-in-the-slot meter, so regulated that, if the mechanism worked properly, he would receive 285 cubic feet of gas for every shilling deposited in the money-box. The meter was first fixed on Aug. 9, and on Sept. 30 it was found that 8500 cubic feet of gas had passed through it, which, at the selling price of 3s. 6d. per 1000 cubic feet, amounted to £1 9s. 9d. On this occasion, £1 7s. in cash was found in the box, which was thus 2s. 9d. short of full payment. On Nov. 16 it was found that 10,500 cubic feet more gas had been consumed, the value of which was £1 16s. 9d.; but there was only 8s. in the cash-drawer—thus showing a deficiency of £1 8s. 9d. This untrustworthy instrument was thereupon recalled next day, and an ordinary meter substituted for it. In the interval, however, an additional 300 cubic feet of gas had passed, and still there was no more money in the cash-box. As the account between the consumer and the Gas Company then stood, therefore, the meter had passed gas to the total value of £3 7s. 6d., for which it had only received shillings amounting in all to £1 15s.; leaving a balance of £1 12s. 6d. against the consumer, which, however, he declined to pay. After taking the precaution of having the meter which turned out so careless in money matters tested by the proper official, who found it correct within lawful limits in respect of its gas-measuring performance, the Company sued the consumer for the balance. It might have been thought that his liability was clear enough, seeing that he had had the gas, and had only escaped the necessity, which he must have been prepared for, of paying for it in advance by a mechanical imperfection of the meter cash-box. One can never tell how such matters will strike the legal mind, however; and in this case the Judge held that the Company could not recover. The defendant pleaded that he only agreed with the Company to take gas by the shillingsworth. Accordingly, when he found that the last shilling dropped into the meter had the effect of releasing any quantity of gas, he had no further concern with the result beyond "taking the goods the gods "provided." If the Company put in a defective machine, that was not his fault, but was their misfortune. Unsound as the consumer's argument was, the Judge decided that it held good in law. It might be interesting to have the opinion of a higher Court upon the point; but this is a luxury to which the Kendal Company do not propose to treat themselves. For the future, they will only supply automatic prepayment meters to such consumers as are willing to sign an agreement stating that the index shall be taken account of in preference to the amount of money found in the drawer; any deficiency or excess to be made good or credited to the consumer, as the case may be. Consequently, the dictum of the County Court Judge will do no great harm, although it is to be regretted that even this small additional illustration should have been given of irritating discrepancy that occasionally appears between law and common sense. Of course, if the consumer had happened to be afflicted with a meter given to the more common fault of automatic prepayment machines—that of failing to render up the article paid for—he would soon have called upon the Company to give him his due, and they would have been obliged to do so. Yet, as a local newspaper remarks, the Gas Company are judged to be entitled to no consideration when the defect tells against themselves, and not against the consumer. This may be law, but it is not justice.

The Report of the Birmingham Gas Committee.

IN another column will be found the report of the Gas Committee of the Birmingham Corporation, and the heads of the accounts relating to the working of the undertaking for the past year, which are to be considered at a special meeting of the City Council to-day. The report mentions the difficulty that arose with the coal contractors in connection with the strike; and it states that the matter has now been amicably settled. Before the deliveries of coal were resumed at the termination of the strike, the Committee had been compelled to purchase coals to go on with; but when this additional supply was not required, it was resold—of course, at a sacrifice. The net result of this operation was, however, to reduce the increased cost of the coal purchased during the strike to £15,000, which cannot be regarded as an extravagant ransom under the circumstances. There has been some trouble during the year in respect of the assessment of the undertaking for the relief of the poor; and although a conflict between the Corporation and the Board of Guardians of the parish of Birmingham was avoided, the differences of opinion between the Gas Department and other rating authorities embraced in the district of supply are not yet permanently composed. The department have also had a dispute with the Midland Railway Company on the vexed subject of the rates payable for the carriage of materials to and from the gas-works; so that, what with one thing and another, the administration of the under-

taking has had a busy year, albeit the technical work does not present any striking novelty. Like many other gas undertakings throughout the country, that of Birmingham shows a falling off in the gross consumption for the year under all the heads among which the Committee divide their output; and this is probably to be explained in the manner that has now become only too familiar. The profit balances for the last two years are singularly even; and the Committee evidently have a close grip of the affairs of the department, which enables them to "cut their "coat" very closely in accordance with their "cloth." Come what may, the subsidy of £25,000 or thereabouts to the rate fund is forthcoming year by year, even if the price of gas has to be raised to 2s. 10d. per 1000 feet to do it. There is nothing whatever said in this year's report on the labour question.

Unsportsmanlike Municipalities.

In parts of the country so widely separated as Rotherham and Newbury, there have of late been heartburnings in the midst of Local Authorities having the control of gas-works. The origin of these troubles is no more nor less than the undeniable truth that the coal strike of last year, coming upon the top of a bad season in other respects, left very many gas undertakings "in a hole." Several Gas Committees of Corporations saw their expected profit balances melt away; and others have been compelled to face their constituents with the lamentable confession that either the price of gas must be raised, or the municipal treasury must go without its accustomed subsidy from the gas consumers. It is impossible for us to investigate the merits of every case of the kind; but we regret to observe that some members of Corporations so affected are betraying a very unsportsmanlike temper in the circumstances. For years they have been very content to milk the gas undertaking for the benefit of the ratepayer, and have built for themselves lordly town halls, and made plain the rough places of their towns, at the expense of the unresisting gas consumer. Now the spirit of the dream has experienced a change; and the same gentry are going about abusing the chairmen of gas committees, gas managers, and everybody connected with the gas-works—except the workmen with votes—because the customary profits are not forthcoming. Frequently as we have inveighed against the policy of exacting more money from gas consumers than from other ratepayers, in the supposed interest of the general body of the latter, we have never dealt with such an aspect of the matter as that which has lately overshadowed all others—the question of what is to be done when circumstances prevent the production of the accustomed surplus from the gas undertaking. In the case of a company, nothing in particular happens. There is usually some reserve of cash to fall back upon, and the shareholders go with a slightly diminished dividend; and there is perhaps an additional penny or two put upon the selling price of gas. In the case of a corporation, however, which never has any reserve that can be drawn upon to equalize profits from one year to another, every passing vicissitude of the gas industry directly affects the ratepayers' interest; and the very demagogues who frantically applaud a miners' strike, are ready a few months later to rend the gas manager limb from limb because gas making with coal 50 per cent. dearer is not so profitable as it is in ordinary times. As already remarked, there is something unsportsmanlike about this behaviour, which leads one to entertain the suspicion that men are not always improved by coming under the influence of the rampant municipalism which prevails in many parts of the country.

The Gas Workers' Conference at Leeds.

During the past week, the Gas Workers' and General Labourers' Union has been in "conference" at Leeds, under the chairmanship of Mr. Pete Curran, who seems to have ousted the meek Mr. Mark Hutchins; the last named being probably "too English" for continuance in an office requiring a fine flow of imagination on the part of the incumbent. The new President, who is described as Labour candidate for the parliamentary representation of Barrow, delivered an address purporting to be a review of the history of the Union from its foundation in connection with a strike at the Beckton Gas-Works. Out of this grew the dockers' strike, according to this veracious historian, and also the movement which has come to be known as the New Unionism. Mr. Curran claimed, as in duty bound, that the Gas Workers' Union is becoming stronger year by year, although it has many battles to fight. "It cost them £10,000 to resist the bogus bonus "scheme of the South Metropolitan Gas Company; and "that Company spent £100,000 in an unsuccessful attempt "to break up the Union." So is history written. The Union now appears to have more to do with glass bottle makers, brickmakers, and the miscellaneous rough trades generally, than with gas stokers; and in going so far afield, the Executive have come to loggerheads with the leaders of other Unions, such as that of the Builders' Labourers, who roundly accuse the Gas Workers of poaching. Mr. William Thorne is still the brains and force of the Union; and nobody knows better than he how difficult it is to keep the organization together. The chief "business" at the Leeds meeting was the revision of the rules; but there was plenty of time for speechmaking at large. A curious letter was received from the Austrian stokers who have been engaged in the recent unfortunate strike. This effusion omitted all mention of the rights of the Vienna affair, while conveying the valuable assurance to the Leeds delegates that "their Austrian comrades are "heart and soul with them in their fight against the "present ridiculous methods of production, and the whole "crew of exploiters." How idle this rhodomontade must appear to a man like William Thorne, who is not likely to quite misunderstand the glaring facts of the Vienna *fiasco!* Mr. Thorne, by the way, accuses Mr. George Livesey of having a finger in the management of the Vienna affair, by reason of the methods of the employers having been the same in Vienna as they were in London. Seeing the strikers lost in both places, this complaint of the General Secretary of the Union is of the nature of a compliment to Mr. Livesey. No pains were spared to glorify the Leeds meeting before the local public and the Press; but it was made very clear that the Union exists now generally for the benefit of anybody but gas workers, and in particular for the advantage of the handful of wire-pullers at head-quarters. How much longer the members will rest content to pay subscriptions for nothing, remains to be seen. In all probability, Thorne would not be sorry to go back to his original job of stoking, whither it is safe to predict that that peculiar "gas worker," Dr. Aveling, will not follow him.

The Value of American Gas Undertakings.

In a farcical work by an American humorist who enjoyed a great vogue in his day, a typical character is made to exclaim: "We are governed too much!" This cry sounded like a comical exaggeration at the time, and it was very probably so intended; for it has always been understood that, in the Land of the Free, nobody is governed more than is absolutely required in the public interest. Yet the Gas Companies of the United States are fast getting into a condition in which they might fairly complain of over-government; if, indeed, they are not already far-gone in this state of bondage. In Massachusetts, the power of fixing the selling price of gas has been taken from the Companies, and assumed by the State, operating through the Board of Gas and Electric Light Commissioners. Now the Legislature is inquiring as to what rights are possessed by Gas Companies against the public authorities of the localities they serve; and it is reported to the House of Representatives by the Committee on Manufactures, who have had this investigation in hand, that, as all lighting companies are subject to competition, municipal and otherwise, there is nothing to prevent any such concern from being ruined in this way by the application of public money to the starting of a rival establishment. It is true that the Committee also report that, while the right of a Municipality to embark in the lighting business should be recognized, there is a very general idea prevalent that it is only equitable that a "private corporation desiring to do "so should have the right to transfer its property "to the city or town rather than to enter into "competition, which might, could, or would be injurious "to both." Yet even this concession to the claims of existing undertakings is not universally made. And what it means where it is offered is shown by a Bill actually before the Massachusetts Legislature, which proposes "that no more shall be paid by a city or town which "purchases a plant from an existing company than the "cost at the present time of a plant of similar capacity."

This, it will be seen, is not exactly an old iron, but a new iron price, and represents rather better terms than Sir Frederick Bramwell is willing to give to the expropriated tramway companies of London.

The Miners in Berlin.

"The Fellowship of Man—the Federation of the World" are noble aims, to the attainment of which the Workers (with a capital letter) are now supposed to be addressing themselves with a zeal and hopefulness to which all the Governments, to say nothing of the "bloated aristocra-"cies" of Europe, are strangers. Yet it is difficult to believe that much headway is made in this direction by such proceedings as those of the "International" Congresses of Trade Union Delegates to which the world has now become accustomed, and which usually end in confusion. The latest example of these futile gatherings has just broken up in Berlin, after a series of stormy sessions, culminating in the withdrawal of the British delegates, who were accused all along by their foreign colleagues of desiring to "boss the show," and who must now be sorry they allowed themselves to figure at such a nonsensical "function." Yet the amiable friend of the Trade Unionists among the London newspaper press—the *Daily Chronicle*—blandly ventured on Saturday to assert of the Berlin Miners' Congress that, "in spite of the little dis-"play of friction on Wednesday, and the more serious "squabble of yesterday, which was followed by the "withdrawal of the British delegates," the gathering was, on the whole, successful. The only way in which such a conclusion can be arrived at is through magnifying "the mere fact that representative working men "from the leading European countries can meet one "another face to face, take each other by the hand, and "contribute, each in his own way, to the general dis-"cussion on matters of supreme economic interest," which is thought to make "for the cause of international "peace." Seeing that the delegates in Berlin manifested a warmer desire to seize each other by the hair than to grasp one another by the hand, and that the idea of many of them as to how they might contribute to the general discussion found expression in inarticulate howlings, the opinion expressed by our contemporary seems to err on the side of optimism. But while these doings in Berlin make it plain enough that the time is not yet ripe for anything more than theoretical "solidarity" among the mining population of Europe, the travelling expenses of the English delegates to the abortive conference cannot be considered as having been wholly thrown away if Mr. Pickard and his companions return persuaded of the facts that, the position of the British miner being far superior in all supessential respects to that of the Continental miner, the latter would not hesitate to cut the throat of his British brother by competition if he had half a chance of doing so. Mr. Pickard went to Berlin to talk platitudes about the necessity of the "living wage;" but he probably knows ere now that British and Continental miners attach widely different meanings to this expression. In labour politics, as in other human concerns, a catching phrase is a useful "stand-by;" but it is the weakness of such forms of speech to be good controversial currency only so long as they are not assayed. A party cry that is explained is as good as lost.

The Chairmanship of the Crystal Palace District Gas Company.—We are informed that Mr. F. L. Linging has retired from the chairmanship of the Crystal Palace District Gas Company, on the ground that his health and years are unequal to the demands of the office. He is succeeded by Mr. George Livesey, with whom he exchanges the position of Deputy-Chairman. In all probability, one reason that mainly determined this action on the part of Mr. Linging was the fact that the profit-sharing scheme was started while he was considering the question of retirement. This movement necessitated the formation of a joint Committee of officers and workmen to carry it out and supervise it; and it was thought to be desirable that the head of the Committee should be the Chairman of the Company. As Mr. Livesey was the prime mover in this matter, and had experience of the work (which must, in any case, very greatly increase the labours of the Chairman), it was obviously to be preferred that he should take the official as well as the actual responsibility for the working of the Company upon the new system. We are glad to know that there is nothing in Mr. Linging's state of health to spoil the hope of his many friends that he may long enjoy the positions in the circle of the gas industry which he elects to retain.

THE INCORPORATED INSTITUTION OF GAS ENGINEERS.

PROCEEDINGS AT THE GENERAL MEETING,

HELD AT THE

INSTITUTION OF CIVIL ENGINEERS, May 9 & 10, 1894.

Mr. Alfred Colson, M.Inst.C.E., President.

PAPERS AND DISCUSSIONS.

In the Journal last week, we commenced the publication of the papers read at the above meeting; giving those of Mr. George Livesey and Mr. S. Meunier, with the discussion on that by the former gentleman. We now continue our report of the technical portion of the proceedings.

Discussion on Mr. Meunier's Paper on "Gas-Works Extensions in Stockport."

Mr. J. Tysoe (East Greenwich) asked if Mr. Meunier was satisfied with the very large retorts mentioned in his paper. It was generally supposed that, on increasing the height, difficulties occurred with regard to stopped pipes by reason of the large space above the surface of the coal, and that, unless a considerable quantity was put in, this space must be there. If, on the other hand, the retort was filled up so that there was comparatively a small space left, he should hardly think the whole amount of the gas in the coal could be got out. His experience was that, with a thick layer of coal, a large yield of gas was not obtained; and this was borne out by his experience of the last three years. He did not know what was the experience of the Stockport works; but if a thick layer was put in, he should imagine there was considerable waste in the quantity of gas obtained per ton. Again, he noticed the ascension-pipes were 7 inches in diameter; and he should like to know if any advantage was derived from having them of this large size. He noticed the yield per mouthpiece was put at 8000 cubic feet; but he was not clear whether this was obtained with a regenerator furnace or with the ordinary one. It seemed to him rather a high make.

Mr. W. North (Stourbridge), invited by the President to speak, said the circumstances were so different between Stockport and Stourbridge that he could not say much with regard to the paper. They used North Wales coal very largely; the retorts were 22 in. by 16 in., and 10 feet long. They only made 15-candle gas, which came out very easily; but they obtained far more per mouthpiece—perhaps 10,000 instead of 8000 cubic feet.

Mr. A. J. Edwards (Taunton) asked if Mr. Meunier was still carbonizing 90 per cent. of cannel.

Mr. R. O. Paterson (Cheltenham) said the question naturally arose why they should confine themselves to a setting of six retorts. He knew, of course, that the practice was followed in different parts of the country; but in the Transactions of last year there were drawings in which settings of ten retorts were fixed, and there were many with nine and others of eight. It was quite evident that there must be a benefit in the larger number, provided the same influences could be brought to bear, in the way of heating and getting the gas away, as they could have where there were only six; and he would ask Mr. Meunier if the advisability of increasing the number from six to eight had occurred to him.

Mr. Meunier remarked that he had used eights.

Mr. Paterson said he had been looking at one of the drawings, which showed a setting of sixes; but his remark would still apply. Why should they stop at eight? Some went to nine. He himself had stopped at eight; but why should they stop there, or at nine either? If they went to five rows of retorts, why not go to more than that? Was there any limit to the size of a retort-house?

Mr. Charles Hunt (Birmingham) said he might ask Mr. Paterson why he stopped at eight. In answering Mr. Tysoe, would Mr. Meunier say what weight of coal he put into the retorts, and how often they were charged. Broadly speaking, the paper appeared to "point a moral" to the effect that, with a comparatively small undertaking,

three works were not found sufficient to supply the district. What was intended to be done with the other works, which appeared to be entirely out of date, and surely were not carried on with the same economy that appeared necessary at the present time?

Mr. PATERSON said he might as well at once answer Mr. Hunt's question, because that bore on the general topic. He was confined to eights because, using regenerative furnaces, he could not go any deeper than he did, and have a proper combustion chamber. Therefore he could not get in the ninth retort. If he could go lower down, and get the furnace arch below the floor, he could use nines instead of eights; but the question would still arise: Why stop at nine?

Mr. C. E. BOTLEY (Hastings) asked how the chimneys were constructed. In his house, the stacks discharged underneath the roof; and the products of combustion had to escape as well as the smoke. He did not like this; and so he carried the chimney-shafts through the arch of the roof, and depended for ventilation upon the cupolas. He had three houses, and none of them were so good as the one where the cupolas were.

Mr. BRYAN DONKIN asked if any attempt had been made to utilize the waste heat from the retorts; and what was the temperature of the escaping gases.

Mr. H. IAGO (Fulham) thought the size of the retorts depended, to some extent, upon the coal carbonized. Using such a high percentage of cannel would account for the large size, and also for the make per mouthpiece. They found in England that a 16-inch retort was a very fair size. They very frequently obtained upwards of 6000 cubic feet per mouthpiece with ordinary Newcastle coal, without any cannel whatever. He was decidedly in favour of large ascension-pipes, especially when working with high heats. He had a system by which he had only one ascension-pipe to one through retort, 20 feet long. They had 8-inch ascension-pipes. He rather differed from the general opinion expressed as to the travel of the gas over heated surfaces. They did not find any depreciation in quality from the gas passing over a large extent of heated coke; and they made the gas of very uniform quality. With regard to the setting of retorts, they had to be guided by the question of manual labour and machinery. With the former, they had to keep the retorts—whether sixes, eights, or nines—down to a certain level. He had some sixes, and found them very good indeed. The make was good; and the wear and tear seemed reasonable. Still the eights would compare favourably with the sixes. With the nines, they required to have the centre bottom retort more in contact with the direct furnace heat; and the life of this retort was considerably reduced. They certainly had a larger make per retort-house of a given size; but the wear and tear was greater. With regard to going to a higher number, they had a lot of tens set in pairs; and they had to charge and draw the top four by means of a travelling stage. Unless the work went on like clockwork, this was a disadvantage, as the travelling stages were always in the way. Again, unless they had a large quantity of flue-room arranged for, the heats were unequal. With the old retorts, he found they had a considerably greater make per man by lengthening the charges. He could not work off in six hours what he considered to be a good charge in the top retorts. He therefore put them on eight-hour work; and when they adopted this system, they were working sixteen gangs to a complete retort-house. By putting in retorts with eight-hour charges, and filling the retorts, he was able to make a larger quantity of gas with fourteen gangs than he had previously done with sixteen gangs; thus effecting a very large saving.

The PRESIDENT having proposed a vote of thanks to Mr. Meunier for his paper,

Mr. MEUNIER, in reply, said he did not find any difficulty with stopped pipes in the 17-inch retorts, though he might say they found a great deal with the old ones. They always worked much better and had less trouble with the 7-inch ascension-pipes on the new beds than with the 5-inch pipes on the old beds. As regards the thickness of the charge, they did not leave much gas in what was put in, but found it thoroughly worked off. They worked 3 cwt. charges in all but the centre retorts, and 4 cwt. charges in those, every five hours. He found that the middles had rather a scorching sometimes; so that they put in the extra weight of coal. They now worked them, however, in four-hour charges of about 3¼ cwt.; leaving the other seven retorts to be charged every five hours as before. This was, of course, at the regenerative end. With the first extension, where the retorts were 26 in. by 15 in., they worked six-hour charges, and put in 3 or 3½ cwt. of coal; varying according to the position of the retorts. The 8000 cubic feet per mouthpiece of which he had spoken was at the new or regenerative end. It was somewhat under the mark, because they had obtained as much as 9000 cubic feet; but as it averaged generally between 8000 and 9000 cubic feet, he thought it as well to give the lower figure. The quality was 19 candles. They did not keep to 90 per cent. of cannel. This was altered at the first opportunity, and reduced to 60 per cent. He had now brought it down to 40 per cent.; but he intended carrying out some experiments with a view of finding out what was the most economical percentage to use. At the new Portwood works, as soon as the alterations were practically completed, he had found that he could get as good a make per ton of the same quality of gas with 30 per cent. of cannel as he could at Heaton Lane works with 50 per cent. Mr. Paterson had asked why he confined himself to six retorts in the first extension. This was rather a "poser;" but, as far as he was concerned, it was simply because he had not much time on his hands to go into debateable matter, and decide whether to have six, eight, or ten. The work had to be done, and done rapidly. The reason why sixes were put in instead of fives, as in the original beds, was to utilize some of the space lost in those settings, and to save putting up a sixth bed. The reason for putting in eights at the other end for the regenerative settings had been answered by another gentleman—he believed by Mr. Paterson himself—who said he had to keep to eights because of differences in levels; he could not go down sufficiently deep. The same thing applied, to some extent, in his case. Their charging was done by hand; and he had to keep the retorts fairly low, and, in addition, to keep the furnace a little high. He found that if he put in nines he could not get sufficient space in the combustion chamber. He believed he had already answered Mr. Hunt's question about the weight and duration of the charges. With the regenerators, it was about 3 cwt. with five-hour charges in the seven retorts, and about 3½ cwt. and four-hour charges in the eighth, or middle, one. When they worked five hours all through, they had to put in 4 cwt., or rather more, in this one. The reason for the three works being needed was simply, he presumed, because there was not sufficient space in the old ones to enlarge. When Millgate was filled up, he supposed no more land could be had; and therefore the Heaton Lane works were built. The same thing applied when they went to Portwood. That was now the only place where they had room to extend. At the present time they were only working at Portwood. During the winter they would have to use Heaton Lane as well; but the old works had not been used for twelve months, and were being kept in reserve. With regard to the chimney, it was rather an oversight on his part not to have mentioned it in the paper. There was a very big chimney, something like 200 feet high and of a very large diameter, attached to the old portion. As it was certainly too good to pull down, they made it act for the whole of the extended retort-house. With regard to the temperature of the exhaust-gases from the retorts, he had not had an opportunity of experimenting, but the first winter he was at Stockport he noticed that the temperature in the main flue was intensely high; in fact, the men used to say it was sufficiently hot to melt cast iron. The next year, after making some alteration, they reduced it; and last winter they brought it down to about a normal. With the regenerator furnaces, a very slight glow could be just seen in the main flue.

Mr. DONKIN inquired if they had tested with metals in the flue.

Mr. MEUNIER said no; he had not been able to find time to do so. With regard to ascension-pipes, he was pleased to hear Mr. Iago say he was rather in favour of large ones. He also said that he had a single one 8-inch diameter for a through retort. He could not say, without knowing more of the circumstances, how it would answer. In his own case, they followed the usual practice of having one at each end; but all the retorts were built up in the centre with 4½-inch walls. The idea of this building up in the centre, he was told on inquiry, was because originally the men could not be got to throw

together. They were always trying to get the better of one another; and the consequence was that these walls were put in 14 inches thick. He found, however, 4½-inch walls sufficient. They worked very well, and saved a great deal of trouble; and so he had adhered to them. Reference was also made by Mr. Iago to a travelling stage being necessary where there were settings of ten retorts. He might point out to him that in a Lancashire town a similar kind of setting was in use, also worked by a travelling stage; and there the experience was the same as his own. There was a great deal of trouble and difficulty; and he was told the retorts did not heat well.

MOTORS FOR LIGHTING OR GENERATOR GAS *V.* ENGINES WITH SATURATED OR SUPERHEATED STEAM.

By Bryan Donkin.

Having been invited to read a paper before this meeting, the author considered that a comparison of gas-motors and steam-engines might not be without interest to the Institution, the members of which are occupied in making lighting gas now so much used for power.

The capital account of gas undertakings in the United Kingdom is about sixty millions sterling; and about ten millions of tons of coal are yearly carbonized. Mr. G. C. Trewby estimates that in London there are 70,000 cooking and heating stoves, and 2500 gas-engines. During the last few years, gas-motors have greatly increased in size and power; and their manufacture has become an important industry, both here and on the Continent. They are better made; and their range of power is very considerable—varying from ¼-horse power up to 600 indicated horse power. Both in size and power, they seem to be progressive. With lighting gas, the sizes mostly in demand are 1 to 10 horse power. The "factor of public satisfaction" is certainly on the increase for small gas-motors.

In all larger gas-works, motive power is continually required, day and night; and arrangements are made to produce it in duplicate in case of any difficulties or accident. Energy or power is chiefly used in these works for driving exhausters, water, tar, and liquor pumps, and coke-breaking machines. Gas-engines are, and have been, used for driving exhausters in small gas-works; but they cannot be said to be popular with gas engineers. The author knows of some cases where they have been removed after a fair trial of some years, and replaced by steam-engines. One inconvenience is that, unlike steam-engines, they must be started with the work off, generally by means of live and dead pulleys. When the engine is running, a clutch is used to connect the motor shaft with the load. With lighting gas, there is generally little gain, in point of economy, per horse power, in using the larger-sized gas-engines instead of steam-engines. A good deal, however, depends upon the size of the engine, price of gas, type of steam-engine proposed, and local cost of fuel.

In comparing the working cost of gas with steam, the author considers that any general data are of little use. The cost and heating value of the gas must be given, whether lighting or generator, and the type, size, horse-power, and make of gas-motor. Lighting gas is much dearer than generator gas when used for power. With steam-engines, the type of engine should be specified, the steam pressure, whether condensing or non-condensing, the speed, whether steam-jacketed or not, and the cost of fuel. The cost of gas per 1000 cubic feet, and of fuel per ton, will vary in each locality. Lighting gas is very much used in hundreds of towns and villages; and for small powers, it is very convenient. It is only necessary to turn on the gas and water, and the engine can be started in a few minutes. With a small steam-engine, a boiler and chimney are necessary; and their application is sometimes difficult in many small workshops and rooms. Getting up steam also takes time.

For larger powers, generator gas only can be employed with advantage in competition with good steam-engines. The gas-generator is equivalent to the steam-boiler; and the heat contained in the coal is, in both cases, transformed into motion or energy through the medium of steam and gas respectively. Such motors have replaced fairly good steam-engines in mills with economical results. Generator gas is specially made in a small separate apparatus, and cannot be used for illuminating purposes. When mixed with air in a gas-engine cylinder, it gives the maximum explosive power. Gas, unlike steam, can be stored in a holder.

The quantity of lighting gas used in tests or trials in internal combustion motors should not only be given in cubic feet per indicated or brake horse power, but the heating value in thermal units per cubic foot should be added, as the gas varies a good deal in thermal value in different towns and cities in England and on the Continent. A little instrument is now sold on the Continent for giving the number of thermal units in any gas; and it seems to yield reliable results. The gas is burnt, so many pounds of water are heated so many degrees, and the heating value is thus determined per cubic foot. The Berthelot-Mahler calorimeter can also be used for determining the heating power of any lighting or other gas. With town gas, the lighting and heating value are in a certain proportion, and have been plotted on a curve.

When town or generator gas comes in contact with pipes or cylinder walls of different temperature, little or no influence is produced on it. The case, however, is different with saturated steam. Until they are hot, the pipes condense the steam; and even when hot and well covered, there is always some condensation due to radiation, and some reduction in pressure. In the cylinder of a steam-engine, there is considerable condensation, as the walls are generally much colder than the steam coming in contact with them; and few engineers give thought to raising their temperature to somewhat near that of the steam by steam jackets, to reduce condensation. Their object is generally to get the cheapest steam-engine; but, as far as steam, fuel, and boiler are concerned, they obtain the dearest. If more power is required, the cry is for more boilers, instead of endeavouring to economize the present steam consumption by making tests and trials on existing engines to ascertain the real facts.

With superheated instead of saturated steam, the case is very different, as, before any condensation takes place and water is formed, it must part with all its superheat. This is the great reason why superheated steam is so economical in steam-engines; it also increases largely the volume of the steam. If steam already exists in any mill or factory, and is necessary for other purposes than power, there is generally little advantage in using gas-motors for economic power in lieu of a good steam-engine.

A comparison of the initial temperature in the cylinder of a non-condensing steam-engine and that in a gas-engine is not without interest. With saturated steam at a pressure of 60 lbs., the temperature is 293° Fahr.; and at 100 lbs., 338° Fahr. Most gas-engines now work at (say) from 2500° to 3000° Fahr., so that the temperature is very much greater with gas; and yet there is no practical difficulty with lubrication.

The cast-iron cylinder walls, in both gas and steam engines, play an important part. In the former, owing to the relatively high temperatures, it is necessary to cool them continually by circulating water, although by this arrangement about 35 per cent. of all the heat received is lost. In steam-engines, the best types are provided with a jacket of steam, with the object of keeping the walls nearly as hot as the initial steam inside; and thus considerably diminishing condensation. The results of steam jacketing have been published in the last few years by a number of experiments made by the Research Committee of the Institution of Mechanical Engineers. The economy effected by properly applied steam-jackets, with sufficiently large steam and water pipes to and from the jackets, is from 10 to 20 per cent. This saving depends much on the type of steam-engine, the percentage of surface jacketed, and whether the engine is single cylinder, compound, or triple, condensing or non-condensing. It is most necessary to jacket the larger cylinder of a compound engine—not only the barrel but the covers; the latter being the most important surfaces.

Lubrication is effected without difficulty in steam or gas motors; perhaps the latter require rather larger quantities of mineral oil. Gas-engines certainly need more attention than steam-engines. This is the opinion of those who have both motors at work in the same mills. Steam-engines work nearly always double-acting, or with two impulses per revolution (with the exception of those going at high speeds). With internal combustion motors, Beau de Rochas' four cycle is chiefly used, giving an impulse every two revolutions; and they are nearly always single

acting. With steam, therefore, there are four times as many impulses as with gas.

Fly-wheels must be heavier with gas than with steam engines, and two are often used. These tend to decrease the mechanical efficiency. Governing is generally done in gas-engines by cutting out explosions; but with both these types of motor, there is now no difficulty in running very regularly—say, within 3 to 4 per cent. of the normal—and both are suitable for driving dynamos, and are largely used for small electric lighting plants. At all the larger electric stations, steam only is used. There is no great difference in the piston speed in feet per minute, or in the number of reciprocations per minute, in these two classes of motors giving the same power.

Where combustion is imperfect, the discharge of the products from gas-engines tends to vitiate the air near; but, on the other hand, there is no smoke, as with a steam-boiler. Starting is much more easily done with steam-engines, and with the work on. Gas-motors must be started empty; and this involves a small additional cost, and risk of breakage. Accidents to the different parts of gas-engines are rather more frequent than with steam-motors; but there is less risk of fire than with a boiler.

The comparative first costs are as follows: A 5 brake horse power gas-engine, running about 200 revolutions for town gas, costs about £80; a steam-engine, single cylinder, non-condensing, non-jacketed, running about 240 revolutions, with vertical boiler, 80 lbs. pressure, costs £80 also; a 25 brake horse power gas-engine, running about 170 revolutions with gas-generator, about £400; a steam-engine of the same power, 120 revolutions, compound, non-jacketed, condensing, with Cornish boiler, 100 lbs. pressure, about £360; a 40 brake gas-engine, running at 160 revolutions, with gas-generator, £570; a steam-engine for the same power, compound, condensing, steam-jacketed, at 100 revolutions, and Cornish boiler, 100 lbs., £470; a 75 brake horse power gas-engine, with two cylinders, running at 160 revolutions, with generator plant, £950; for the same power, a steam-engine, compound, condensing, steam-jacketed, 95 revolutions, with Lancashire boiler, 100 lbs., £670. Generator gas should be used where economy is an object—say, for engines above 12-horse power.

The mechanical efficiency of the two motors is the percentage of the brake on the indicated horse power. In well-made steam-engines, it is from 85 to 90 per cent.—in other words, from 10 to 15 per cent. of the total indicated horse power is required for driving the engine itself. In well-made gas-engines, experiments have shown that the mechanical efficiency is from 80 to 85 per cent. In steam and gas engines, the thermal efficiency, or the percentage of heat converted into work to the total heat received, varies much with different engines, according to speeds, sizes, loads, pressures, and temperatures used. In good steam-engines at full load, it is from 10 to 14 per cent., depending on steam pressures, speed, &c. With good gas-engines at full load, it varies from 18 to 23 per cent. It should be stated, in experiments and making comparisons, whether these are made with full or half load. Gas-engines work with less economy at light loads than steam-motors. In the case of gas-engines driven by town gas, there is no solid residuum, as with steam-boilers and gas-generators; thus avoiding the small cost of carting away ashes and clinkers.

In comparing gas with steam, if the work is likely to be intermittent, and the motor frequently stopped and started, as is very often the case with small motors, gas is found much more convenient than steam. For working continuously, night and day, all the year round, steam is, however, more reliable, particularly in applications where any stoppage, even for a few minutes, would have serious consequences. In gas-works, where steam-engines are nearly always used, better types should be selected, and steam-jackets used to economize steam and fuel. Steam-pipes should be more carefully covered, and the engines more often tested and indicated.

By superheating, the temperature of the steam is raised without affecting its pressure; and this is generally carried out by placing superheaters in the boiler-flues, or utilizing the waste heat at the end of the boiler. There is considerable economy in using superheated instead of saturated steam. Such steam is now largely used on the Continent, without any practical difficulties, in some 100 to 200 engines, developing 10,000 to 15,000 horse power. It is employed in all kinds and types of steam-engines—single-cylinder, compound, and triple, jacketed and non-jacketed, condensing and non-condensing. In the Proceedings of the Institution of Civil Engineers and various Continental societies, there are accounts of many trials of superheated *versus* saturated steam. The gain in economy, according to these experiments, depends upon a variety of circumstances, the type of engine and boiler used, and how they are worked. It varies from 10 to 25 per cent. when the superheaters are placed in the boiler-flues.

The author has made many experiments with different types of superheating apparatus, and one quite lately at Hamburg; and he has always found very considerable economy due to its use. This steam is found to raise the temperature of cylinder walls; and it parts with its heat without causing condensation. The degree of superheat varies from 30° to 100° Fahr.—that is, the steam is heated to this extent above the temperature corresponding to the pressure. Thus, with 50 lbs. of saturated steam having a temperature of 298° Fahr., if superheated 100° the temperature will be equal to 398° Fahr. With 100 lbs. of saturated steam, having a temperature of 338° Fahr., if 100° superheated the temperature will be equal to 438° Fahr. There is, however, considerable prejudice against its use; but, with proper mineral oil and ordinary care, the slide-valves and pistons give no trouble, if the superheating is kept within moderate limits. Moreover, the temperatures used are always very much lower than in gas-engines. Professor Kennedy has made a trial on a small Serpollet boiler, generating steam with 200° Fahr. of superheat. With a small non-condensing engine 5 in. by 5 in., running at 285 revolutions per minute, the result was 25½ lbs. of steam per indicated horse power per hour with 55 lbs. pressure. This is only about half the steam consumption of an ordinary steam-engine of this size. The engine piston and valves were in good order after a long time. In another test on a small non-condensing engine with 5-inch cylinders, and running at 284 revolutions, using superheated steam, the steam per brake horse power was only 30 lbs. This experiment has lately been made by Mr. Sequin in Paris with 4 atmospheres steam pressure.

For the purpose of comparison, it will be well to divide gas-engines into five categories:—

1 to 10 B.H.P. .	Smallest size, suitable for town gas. Consumption about 21 to 23 cubic feet per I.H.P. of London gas at full power on trial.
10 to 50 B.H.P. .	Medium size, for either town or generator gas, according to the price of town gas and fuel. Consumption about 20 to 22 cubic feet per I.H.P. of London gas at full power on trial.
50 to 100 B.H.P. .	Large size, for generator gas. Consuming 1 to 1¼ lbs. of good fuel per I.H.P. per hour on trials at full power.
100 to 500 B.H.P.	Largest yet made, for generator gas. Using about 1 lb. of good fuel per hour on trials at full power.
500 to 1000 B.H.P.	Not yet made.

Steam-engines are made in all these sizes, and much larger. By far the greatest number of gas-engines are made of the smallest size, from 1 to 10 indicated horse power, and using town gas. For medium size also, large numbers are sold; but for 50 to 100 horse power engines there is a much smaller sale. The above quantities of gas and fuel are about what would be consumed on trials with a full constant load, not with intermittent work. London gas may be taken as yielding about 615 to 635 thermal units per cubic foot; and generator or Dowson gas about 160 thermal units per cubic foot. From these figures, and knowing the cost of gas per 1000 feet, or the cost of fuel and probable load, the approximate cost, working by day or week, can be calculated for a given town.

The figures contained in the following table have been taken from Professor Witz's report, and they have been rearranged and put into the present form by the author. But he cannot altogether agree with these figures, as, with a more economical steam-engine of the best type, only 1¾ lbs. of best coal per brake horse power would be sufficient at a moderate speed and steam pressure. With this latter consumption the cost per day with steam and gas would be about the same. But then it may be said that the best large modern gas-engines, with generator gas, would only require about 1 lb. to 1¼ lbs. of good fuel; so that the above proportion would not probably be altered materially. Much will depend on the price of fuel in the particular town under consideration.

Mr. Dowson has done much, and was the first to make and introduce cheap generator gas, and to bring its advantages well before the public. He has written several excellent papers comparing steam and gas engines. A

Comparison of the Working Costs per Day for a Gas and a Steam Engine with about 76 Brake Horse Power.

Particulars.	Steam Engine and Boiler to Compare (not Actual Trial).	"Simplex" Gas-Engine and Gas-Generator Test by Prof. Witz.
Heat agent	Welsh coal, 4 per cent. ashes	Coke, 6 per cent. ash; anthracite coal, 5½ per cent. ash.
Heating value	15,700 T.U. per lb.	
Generator, &c.	Lancashire boiler, 650 sq. ft. heating surface	Gas-generator.
Pressure	5 atmospheres = 75 lbs.	Pressure of explosion, about 120 lbs. per square inch.
Medium	8½ lbs. steam per lb. coal	Gas = 83·7 cub. ft. per brake horse power.
Thermal efficiencies.	72 per cent. boiler	70½ per cent. generator.
Cylinder	Steam, single cylinder	Explosion and combustion of gas, single cylinder.
Action	Double acting	Single acting.
Impulse	4 impulses per 2 revolutions.	1 impulse per 2 revolutions.
Diameter	15¾ inches	22½ inches.
Stroke	3 ft. 3 in..	3 ft. 1½ in.
Revolutions per min.	66.	101.
Piston speed	435 feet per minute	630 feet per minute.
Kind of jacket	Steam-jacketed walls, heated.	Water-jacketed walls, cooled.
Piston	Ordinary piston	Plunger piston.
Initial temperature	70 lbs. = 316° Fahr.	2200° Fahr. about.
Engine thermal efficiency, or percentage of heat turned into power to total heat received	9¾ per cent.	18 per cent.
Thermal efficiencies.	7 per cent. boiler and engine.	12·7 per cent. generator and engine.
Mech. effic. of motor.	75 per cent.	69 per cent.
To drive engine itself	25 „	31 „
	100	100
Water	Condensing and feed	For jacket water, say one-fifth that required for a steam-engine.
Oil for lubrication	Rather more required for gas-engine.	
Lbs. coal per B.H.P.	2·6 lbs.	1·34 lbs.
B.H.P.	75.	76.
Space occupied	360 sq. ft. engine, including boiler and chimney	470 sq. ft. engine, including gas-generator.
First cost fixed	£1290 for engine, boiler and chimney, pipes, and foundations.	£1290 for engine, pipes, gas-generator, &c.
Cost of building	About the same in each case.	

Cost per Day of 10 *Hours for the Foregoing Steam and Gas Engine.*

[As given by Professor WITZ.]

Steam.				Gas.			
Depreciation, repairs, and interest	£0	13	6	Depreciation, repairs, and interest	£0	13	6
Welsh coal, 2·6 lbs. per B.H.P. for 10 hours, at 23s. per ton	1	0	0	1·34 lbs. per B.H.P.	0	12	0
Oil and grease	0	1	3	Oil and grease	0	2	0
Driver	0	5	0	Driver	0	5	0
				Battery, &c.	0	0	4
Total	£1	19	9	Total	£1	12	10

Or a difference for ten hours' work of 6s. 11d. per day in favour of gas, or (say) £100 a year, taking 300 days. This is the calculated saving for these particular motors, exclusive of getting up steam or gas, and during gas trials at constant full load.

few extracts from trials, &c., from his last paper at the Institution of Civil Engineers are here given.

According to Mr. Dowson, gas-engines for electric lighting, developing about 7000-horse power, have been sold in England, and "Otto" engines for 11,000-horse power in Germany. Doubtless the majority of these work with town gas. Messrs. Crossley say the number of "Otto" gas-engines in use in England is now about 20,000; and we may assume perhaps nearly double this number for all kinds of gas-engines. To give the best economy, a gas-engine should be worked at full load. There are no high-power gas-engines for electric supply stations yet working in England, or in large cities on the Continent; all the existing central stations using steam. In London, mostly quickly-running compound and triple Willans engines are employed; but there are also other types, chiefly non-condensing. Mr. Dowson advocates the use of gas-motors and generator gas instead of steam for central electric stations.

A Dowson gas-generator usually consists of a small steam-boiler giving superheated steam, a generator, a cooler, a sawdust scrubber, and a holder. The gas passes through water twice, and finally through the coke and sawdust. For an 80 brake horse power plant, the cost erected is about £325; for 530-horse power, about £1100.

At "Chateau Say," with 650 glow lamps, an "Otto" engine, with Dowson gas, consumed 1·2 lbs. of fuel per indicated horse-power-hour.

At the Chelsea Flour-Mill, a 60 nominal horse power twin-cylinder gas-motor, with Dowson gas, 17 inches diameter and 2-feet stroke, going at 156 revolutions, and giving 118 indicated horse power, has been about two years at work. The amount of anthracite and coke used during a constant full load test was about 0·87 lb. per indicated horse power per hour. The governing is said to be satisfactory; and the cost of wages and lubrication is about the same as with a steam-engine. The gas consumption is 63 feet per indicated horse power per hour.

At the Severn Tweed-Mills, New Town, there are four gas-engines, with Dowson gas developing about 200-horse power. Total fuel per brake horse power per hour 1¼ lbs. of anthracite—six days' test. Cost per brake horse power = 0·13d. With coke from gas-works, only 1¾ lbs. per brake horse power were used. The cost per brake horse power was the same as with anthracite, as the coke was cheaper.

At the Godalming Paper-Mills, there are several gas-engines, giving some 400 indicated horse power. Generator gas is used; and the average consumption of fuel is given at 1 lb. per indicated horse power per hour. Messrs. Spicer consider that gas-engines require more attention than steam-engines; and they have had some breakdowns with them.

At a weaving-mill at Halifax, there are four gas-engines of about 200 indicated horse power, using generator gas from gas coke. The consumption is about 1·4 lbs. per indicated horse power per hour.

At the Uxbridge Water-Works, a water-pumping test was made in February, 1892, using generator gas. Consumption, 1 lb. of coal per indicated horse power, or 1⅜ lbs. per horse power of water lifted per hour. Approximate power, 16¾ indicated horse power. The Surveyor of these water-works has recently reported on the cost of the present gas-engine, as against the former old steam-engines. With *steam*, working 14 hours per day, it was £555 per year; with *gas* (? town gas), working 17 hours, £374 per year. The type of steam-engine is not given.

A 25-horse power double-acting Griffin gas-engine, tested by Messrs. Dick, Kerr, and Co., gave from 82¼ to 83½ per cent. of mechanical efficiency. With Messrs. Crossley's 30-horse power nominal "Otto" gas-engines, the mechanical efficiency was 86 per cent.

The best fuel for generating Dowson gas is anthracite, as it yields no tar. If anthracite is too dear, gas coke can be used. Comparing Dowson gas and 16-candle power lighting gas, their relative explosive force is about 3·8 : 1; so that about four times the volume of the former is necessary to give the same power as with average town gas. There is a large proportion of nitrogen in this gas; and it is easy to see how great must be the excess of nitrogen, as soon as the gas is diluted with air and ready for explosion. Sir W. Siemens mentions—and it has been confirmed by others—that, when town gas is used for driving gas-engines for an electric generating station, the consumption of gas is about 50 per cent. less than the volume of gas required to give the same amount of light in ordinary burners.

The following is taken from the recent and very interesting Howard Lectures of Professor W. C. Unwin, F.R.S., at the Society of Arts, on the "Development and Transmission of Power:" Many of the disadvantages of solid fuel are diminished by employing coal to produce gas, and using it in internal furnaces or gas-engines. Gas-motors work with a higher thermal efficiency than steam-engines. The cost of ordinary lighting gas is increased, both by the need of a large generating plant to meet the great fluctuations in the demand for lighting and heating, and by the large distributing charge involved in supplying a great number of small consumers. If gas were made especially for heating and power purposes, either coal, water, or producer gas could probably be distributed to power users at less than half the present price of coal gas. From test trials made on a large pumping-engine of the London Hydraulic Power Company, the consumption was 2·2 lbs. of coal per indicated horse-power-hour; but in ordinary intermittent work, it is one-third more. This includes keeping the boilers hot, getting up steam, stoppages and starting of the engine, and with very different loads by day and by night.

The whole of Messrs. Crossley's large works are driven by gas-engines and Dowson gas from anthracite coal. There are eight gas-motors of from 12 to 30 nominal horse power, indicating collectively about 325-horse power. In reply to the author's inquiries, the firm state that the consumption per indicated horse-power-hour is from 1 to 1¼ lbs. The net cost to them of the anthracite fuel, labour, interest on capital, and repairs, works out at about 2½d. per 1000 cubic feet. Comparing this with average town gas, and allowing for thermal value per cubic foot, the equivalent cost would be about 10d. per 1000 cubic feet. About 2000 engines were made at these works last year.

A single-cylinder gas-motor, indicating 280-horse power, driving a large flour-mill in France, was lately seen by the author working with generator gas from French coal. The preliminary trials gave about ¾ lb. per indicated horse power per hour. This is taking the coal over about two weeks, with continuous work night and day with full load. This engine will give a maximum of 320 indicated horse power. The maximum pressure of explosions in the cylinder is about 200 lbs. per square inch.

Professor Kennedy says* that, at half load, the consumption with gas or steam engines per brake horse-power-hour is about 40 per cent. more than at full load. It was mainly here that the loss in the engine due to "load factor" comes in. A steam-boiler does its best at half to three-quarter power; and at quarter power it works very wastefully. When a boiler is only kept hot, but not supplying steam, it may be called the "stand-by" loss. The Professor adds that, from his experiments with boilers, by shutting down the stop-valve, he reduced this loss to 10 per cent.; or the consumption of fuel in a boiler not making steam was about 10 per cent. of the whole consumption. In case of fog, in electric stations or in large gas-works, it is often necessary to keep up steam, so as to be ready for an engine start at any moment. Professor Kennedy uses in the electric supply stations under his charge non-condensing engines, giving on test trials 24 lbs. of steam per electric horse power = 32 lbs. of steam per unit. His boilers give 11 lbs. of steam per pound of good coal; and 9½ lbs. reach the engine during a test. This works out to 3·4 lbs. of coal per electric unit delivered on a test. Instead of this, the actual figures for three to four weeks gave 5·3 lbs. This important difference between a test trial and several weeks' run is due to all losses at the station; keeping boilers and pipes under steam, and engines running at different loads, &c. As to a saving, by improving the engine load factor, a gas-engine would not, he considers, help at all. Such an engine has exactly the same drawbacks as a steam-engine in this respect; and more information is needed as to losses in a gas-generator over several weeks, corresponding with the losses in the steam-boilers mentioned.

The author has lately made some experiments with Mr. C. C. Carpenter on a compound horizontal condensing steam-engine at the Vauxhall works of the South Metropolitan Gas Company, using saturated steam. Six trials were made—three with, and three without, steam in the jackets. The results of these experiments gave from 12 to 16 per cent. gain due to the jackets in use. With 60 lbs. pressure in the boiler, and with all the jackets in use, 19⅓ lbs. of steam per indicated horse-power-hour were consumed. The Cornish boiler used gave an evaporation of 8 to 10 lbs. of dry broken coke from a temperature of feed water of 212° Fahr. Dry coke per indicated horse-power-hour, 2·5 lbs.; coke per brake horse-power-hour, 2·7 lbs. Taking the price of coke at 13d. per cwt., this will give 0·3d. per brake horse power per hour. The indicated horse power varied from 43 to 63 in different tests; but the load was kept fairly constant during each eight hours' run. The thermal efficiency of the engine, with 60 lbs. steam and all jackets on, was 12¼ per cent. The boiler efficiency varied from 63 to 79 per cent. according to the method of stoking. The boiler was not forced. The calorimetric value of 1 lb. of gas coke varied from 12 to 13 lbs. from 212° Fahr. per cent.; ash and clinker in coke, 9 to 14 per cent. The priming of the boiler was under 0·5 per cent., or practically *nil*.

Mr. Holgate gives the following figures as to the first cost of steam and gas motors for an electric plant of 1160 indicated horse power for 10,000 incandescent lamps; Area available, 880 square yards. Steam—Five 160-horse power boilers, six steam-engines, six dynamos, ropes, &c., £18,365. Gas—Dowson generator plant, eleven gas-engines, eleven dynamos, belts, &c., £16,500.

Mr. Denny Lane has advocated the distribution of power gas for gas-engines by mains in the usual way, as being a much cheaper method of distribution than with wires for electricity, pipes for water or air, or other methods. He says that a 6-inch gas-main costs about £550 per mile, and at 4 inches pressure would deliver 9000 cubic feet of gas one mile, and would yield about 350-horse power, and at a higher pressure much more. A 6-inch, more expensive, water-main, under the usual pressure of 750 lbs. per square inch, will only carry about 116-horse power. The cost also per horse power by this hydraulic system is very much greater than with gas. Mr. Lane considers that good heating and power gas can be produced on the works for 1s. 6d. per 1000 cubic feet with a profit.*

It may be of interest to add the description of a method of working in use for the last ten years, in which lighting gas is supplied for a certain number of hours during the 24, and cooking and power gas for the remainder. At the Winterthur Gas-Works in Switzerland, the two kinds of gas are supplied through the same set of town mains, but from different gasholders. Illuminating gas is supplied during the few dark hours of the day; and power gas for the remaining or much longer time. In this way the mains of the town are utilized, and earn interest during the longer portion of the 24 hours, when power, heating, and cooking gas only is required. Some two or three hours before dusk each day, the gas is enriched by using cannel coal. After midnight, the use of this coal is suspended, and power gas is distributed from another holder; the larger holder being shut off. The number of hours per day and night these two kinds of gases are available to the consumers varies, of course, with the season. The cooking and power gas is much in demand; but some little inconvenience is felt by the consumers during the change from the power to lighting gas, and until the mains have become filled with illuminating gas. In large cities or towns, this inconvenience would be fatal; but for smaller industrial towns and villages, where cooking-stoves or gas-engines are, or in the future may be, much used, it might probably be supplied, by permission of the authorities, with advantage to all. When this duplex system was started, the consumption of heating and power gas was about 10 per cent. of the total; but now it is about 50 per cent., and is still on the increase. There are some 46 gas-motors at work, and 800 cooking-stoves. The population of this town is about 19,000. The charge for lighting gas is 5s. 7d., and for non-lighting gas, 3s. 4d. per 1000 cubic feet—a very considerable reduction; and at the same time it is much better suited for cooking, heating, and power. The owners of these gas-works have paid better dividends during this double gas supply, and have also been able to reduce the prices. They now belong to the community of the town of Winterthur.

There are about 29 towns in Switzerland (or more than half the gas-works in the country) which are selling power and lighting gas on a similar system, and using the same mains for both. Coal costs in Switzerland about 26s. 5d. per ton; and cannel coal, about twice as much. To carry out this system, there are two gas-meters in every house; but one service-pipe from the street main serves for both. The outlet-pipes from the meters are connected with different rooms, as may be desired, for lighting, or cooking and motive power. Sometimes a single meter is used with a clock attached, which automatically turns off or on at a certain time one or the other quality of gas. In other cases, automatic arrangements of a different character are used. In Switzerland there are from 600 to 700 gas-engines in 37 different towns, with a total of some 2000-horse power, mostly for small motors. About one-tenth of the gas at present made at Winterthur is used in the streets—something like half for private illumination, and the rest for power and cooking.

The author has referred to many descriptions and trials given in *Engineer* and *Engineering*, and also to various papers and proceedings of English and Continental institutions and societies; and he finds that the most economical steam-engines (exclusive of high-speed motors, some of which are very economical) are those of the Sulzer type, made by Messrs. Sulzer and Messrs. Carels.

* See Proc. Inst. C. E., Vol. CXII.

* See Inaug. Address to Gas Institute, JOURNAL, Vol. LXI., p. 1091.

They are all thoroughly steam-jacketed, and are used for mills and for driving dynamos, in sizes from 50 to 500 horse power and larger. Many tests have been made on these engines by independent experts, and by French, German, and Belgian engineers. For details of these, the author's letter to *Engineering* of Jan. 15, 1892, may be referred to.

In single-cylinder condensing engines using 70 to 80 lbs. pressure, the consumption varies from 18¾ to 19¾ lbs. of saturated steam per horse-power-hour. Taking a good boiler and good coal, giving 10 lbs. of steam per pound of coal—a rate of evaporation which has often been realized, and even exceeded, in good practice—the coal consumption would be 1¾ to 2 lbs. per indicated horse-power-hour.

With compound condensing engines and pressures of 80 to 100 lbs., the consumption was 14 to 16 lbs. of saturated steam per indicated horse-power-hour; and taking 10 lbs. of steam per pound of coal, as before, this gives 1½ lbs. of coal per indicated horse-power-hour.

With triple condensing engines working with steam pressures from 100 to 150 lbs., the consumption was from 12 to 13 lbs. of saturated steam per indicated horse-power-hour; giving, under the same conditions, 1¼ lbs. per indicated horse-power-hour. The above figures include the jacket water. If superheated steam were used, these figures would be still further reduced; so that in trials with the best number of expansions in triple engines and constant load, we may expect soon to attain a consumption of 1 to 1¼ lbs. of the best coal per indicated horse-power-hour. It is assumed that the engines and boilers are properly worked, and not forced.

In conclusion, the author has endeavoured to make a fair comparison between gas and steam motors, and has quoted the most reliable modern trials he has been able to find for both classes. In choosing between these two motors for a given load and set of conditions, the considerations mentioned should be carefully taken into account. The first cost must naturally be considered, although the cost of daily working is much more important; next the price of fuel and gas in any given locality; and then the risk, convenience, noise, vibration, horse power, &c. There is no doubt that considerable economy is still to be realized both in gas and steam engines. The best oil-engines, like gas-motors, have a great future before them; there being no boiler and no gas-generator. They are now competing closely with gas; and they may eventually prove to be the most economical and convenient internal combustion motors without boilers for many purposes.

Discussion.

Mr. J. F. Bell (Stafford) said there were one or two questions he should like to ask Mr. Donkin. He stated that, where economy was an object, they should use generator gas; but after discussing this matter some time ago with Mr. Dowson, he came to the conclusion that, with coal gas at 2s. 3d. or 2s. 6d. per 1000 cubic feet, it would not pay to put up generators for less than a 50-horse power gas-engine. Another question in which he was much interested was the system adopted in Switzerland, where two qualities of gas were supplied. In his own town, they had adopted this practice to a limited extent. They supplied 15-candle gas in the daytime, and in the evening (one hour before sunset) carburetted it up to 18 candles. For the gas in the daytime they charged 2s. 3d. per 1000 cubic feet; being about 6d. less than the price of lighting gas. They also fixed separate meters. No charge was made for the hire of meters: but if an additional one were fixed to register gas employed for cooking, heating, or motive power, consumers had to consume or pay for not less than 8000 cubic feet each quarter, in order to obtain it at the lower rate. This had given great satisfaction; in proof of which he might state that, though Stafford was not a growing town, during the last twelve months they had had a considerable increase, though in most places there had been a decrease. The author of the paper had quoted Mr. Holgate as giving the cost of gas-motors and generators as less than steam-engines. He went closely into this matter, having had to advise with an electrician with reference to putting down an electrical plant; and he came to the opposite conclusion, as they found that the cost of gas-motors was so much higher than steam-engines that they adopted the latter—of course, considering also the question of steadiness of running. No doubt obtaining power by means of generator gas and gas-motors was very economical; but it must be remembered that, in making generator gas, anthracite or coke had to be used, which was costly compared with cheap slack suitable for firing purposes, which could be obtained in most towns. He must add his thanks to Mr. Donkin for his valuable paper. It was, no doubt, in the interest of the profession to encourage the use of gas-engines; and when ordinary town gas could be supplied for 2s. 6d. per 1000 cubic feet, it was a very economical method of obtaining power.

Mr. T. Holgate (Halifax) asked whether, in the comparison of the cost of steam-engines and gas-engines, the author had included the chimney required in connection with the boiler. No mention was made of it; and it would form a considerable portion of the total cost. With reference also to the figures quoted in his (Mr. Holgate's) name, giving the cost of a generator plant for an electric lighting station, he might say that the amount there stated did not include the outlay for a chimney, because on the site proposed there was one already erected. With reference to what had been stated by Mr. Bell, he might say that those figures were obtained from electricians who had had considerable experience in the erection of steam-generating plant, and that the cost for gas plant was furnished by eminent makers of gas-engines. It must be remembered, when instituting a comparison between the use of Dowson gas and coal gas for power, that a gas-engine required to be about 15 per cent. larger when generator gas was employed, and, further, that this gas was not so cleanly in use as coal gas. He was informed, by those who used large gas-engines with the former gas, that the valves must be cleaned daily; whereas this operation required to be performed only once a week with coal gas. As to the best method of using steam in gas-works, they would all believe it was not worth spending much money to obtain very great fuel economy, because most gas-works were provided with appliances whereby steam could be generated from breeze at a small cost. It might be advisable to have good appliances, which would reduce the amount of labour or the capital expenditure on steam-boilers; and he should like to know from Mr. Donkin whether he considered that it would be better in gas-works to jacket the steam cylinders of gas-exhauster engines, or to use a superheater. For himself he was inclined to believe that a steam-jacket, fitted with a steam-loop to return the condensed water to the boiler, might be the best method. Reference had recently been made to a superheater devised by Messrs. M'Phail and Simpson, which was used with fairly good results in the West Riding of Yorkshire; but it remained to be seen if it was more durable than those which preceded it.

Mr. G. C. Trewby (London) said the paper under discussion was rather one for experts; and he could not say that he had had any practical experience of the comparison between gas and steam engines. With regard to the use of non-illuminating gas for working engines, he went into the question some two or three years ago, and found that, as far as London was concerned, it was a thing which was practically impossible, because the mains would require to be of about four times the capacity of those used for illuminating gas; and the consequent increase in capital would more than counterbalance any advantage. By Mr. Donkin's own showing, the difference between London gas and Dowson gas was as 1 : 4; and this just bore out the conclusion he came to. Again, he did not think the cost of steam-engines and boilers could include either foundations or the cost of the chimneys. The estimate for the 75-horse power steam-engine, with Lancashire boiler, was put at £670; and there was only one boiler mentioned. Now, with a gas company (and he presumed with many other undertakings), it would be necessary to have that in duplicate; and this would increase the cost considerably. There were, no doubt, a great many uses for gas-engines. About the first they put down at Beckton was for the purpose of pumping sewage from the Company's cottages; and he believed that this engine was still at work. The cottages were on a very low level; and it was necessary to pump the sewage into the sewer. The engine did not require any attention, as it only worked a certain number of hours each day, and when once started it did not require watching. Perhaps Mr. Donkin might be aware that, some time ago, a trial was made of a gas-engine for driving tramcars; and Professor Kennedy, who carried out some experiments, told him that it was very successful indeed, and that it only required 24 cubic feet of gas per tram-

mile. He worked this out, at the London price for gas, to 0·888d., or one might say a penny. The cost of horses, without depreciation, would come to about three times this amount. This was a case in which steam could not very well be employed; and certainly a gas-engine offered many advantages.

Mr. Denny Lane (Cork) said he believed that he was the first person who pointed out, in a short letter to the *Engineer* a great many years ago, the thermal efficiency of gas-engines as compared with steam-engines; and he then showed that in steam-engines about 10 per cent. might be converted into power, whereas in gas-engines 18 or 20 per cent. had been obtained. He had also reason to recollect that, about nine years ago, he read a paper on the subject of gas-engines at the meeting of The Gas Institute in Manchester;* and the following year, having the honour to be President, he had the extraordinary experience of having to present himself with a medal for the best paper read the previous year. He therefore took considerable interest in this subject, and devoted a great part of his address to the Institute at Belfast last year to the question of the application of gas to the production of the electric light. It was a great advantage to have, as the advocate of the steam-engine, a gentleman who held the very highest position in England as an engineer. He did not know that any one else had devoted so much time and ability as Mr. Donkin to practical experiments on the steam-engine; and they were also aware of the quality of the work he produced. In some cases, it might cost a little more in the first instance; but there could be no question of the superiority of the workmanship, and the excellent finish which characterized it. They had, therefore, he might say, an advocate for the steam-engine who was probably slightly biassed in its favour. Now, Sir Frederick Bramwell some time ago said that the progress of the internal combustion engine was so great, that he considered that in about sixty years the steam-engine would only be found in a cabinet of antiquities, as everywhere they were to be superseded by gas-engines. It was probably for this very reason that Mr. Donkin had come to sing for the older engine "the song of the Dying Swan." The examples he had given of the steam-engine were very favourable ones. But there were many cases most unfavourable; and he might refer again to Sir Frederick Bramwell, who stated that, when experimenting on the number of pounds of coal per horse power used in a considerable number of small steam-engines in Birmingham, he discovered that the average consumption was 18 lbs. per horse power per hour, instead of $1\frac{1}{2}$ or $1\frac{3}{4}$ lbs., as in the steam-engines to which Mr. Donkin had referred. With regard to small steam-engines, he did not think there could be any question whatever as to the superiority of the gas-engine, wherever gas was sold at a moderate price. In the first place, there was practically no attendance required. If the engine were looked after once or twice a day, to see that there was sufficient oil in the lubricators, nothing more need be done. He had had under his own inspection a gas-engine which had been running for 14 years; and at the end of that time it required no repairs with regard to the cylinder, except a new lining, which came to only $2\frac{1}{2}$ per cent. on the first cost. Of course, at that time engines were made with a slide-valve, which was complicated, and required a good deal of attention and cleaning. But this had now been remedied; and with the modern system of tube ignition, there was no trouble with the valves. He was very fond of steam-engines; but he could not say that his affection extended to boilers, particularly small ones. A small steam-boiler with a small evaporating surface required constant attention; and if the man neglected it for a time, the water ran too low, the fire-box was injured, and expensive repairs were then required. Taking into account merely the questions of attendance and the wear and tear of boilers, the small steam-engine could in no way hold its own against the small gas-engine. Again, if the men wanted to start work at six o'clock, it would be necessary to have someone there at five o'clock or even earlier, to get up the steam; and steam must be kept up during the breakfast and dinner hours. None of these things were necessary with the gas-engine. Even the larger ones now had self-starting arrangements; so that, up to 20-horse power or more, there could not be any comparison in economy between gas and steam. He knew an instance of a printer, carrying on a large business, and employing a steam-engine, who was induced to try a gas-engine. At the end of the first year, the saving in labour and trouble had nearly paid for the engine; and the result was that he ordered a larger one, and then two others. Another matter which had lately greatly attracted the attention of engineers, especially electrical engineers, was the distribution of power. They had argued that it would be better to have one large dynamo working several motors, each working some small set of machines—that it would be a saving by doing away with the great friction arising from shafting and so forth. Now, a gas-engine lent itself very readily to this. Even if they used generator gas (which he might say he did not think much of, for more reasons than one), they need only have one generator, and the gas might be distributed to several engines. Some years ago, an eminent Scotch professor tested the amount of power that reached the spindles in a spinning-mill. The proprietors allowed him to begin with the steam-engine running idle, and then shaft after shaft was added; but, in the end, only about 10 per cent. of the whole power generated actually reached the spindles. This showed a great loss of power. Then the application of gas to driving tramcars had been alluded to. He had lately read a very interesting paper on the subject, published in the transactions of a German Gas Association. It was considered that the consumption of gas per tram-mile was about 30 cubic feet; and the price of gas, where the experiment was tried, was about 4s. 5d. per 1000 cubic feet. The result was that, using a gas-engine, the whole cost, including the wages of conductors, expenses at the compression station, and everything else, was only 3d. per mile; and calculating it at the price of gas in London, it would be less. The cost of traction by horses, instead of being 3d., was 6d., 7d., 8d., and even 9d. per mile in some cases. He did not think steam traction would ever become popular for tramcars. There would be the engine and boiler to carry about; and the wear and tear would be so great that he did not think they would be much use, but that probably, in the future, tramcars would be nearly all driven by gas-engines. A most remarkable statement recently appeared in a French paper—the *Revue Industrielle*—which struck him as so extraordinary that he wrote to the Editor for an explanation, but he had not yet received it. It was to the effect that a vessel of 280 tons had run from Paris to Havre by the Seine, which was about 230 miles, and had done the whole distance worked by gas-engines, with only a single charging-station about mid-way—namely, at St. Étienne de Rouvray. What had puzzled him was how a vessel of 280 tons could manage to carry gas enough to go such a distance, especially as from Rouen up to Paris there was often a considerable current in the Seine. The difficulty was for the vessel to stow enough gas in some tubes under the bridge. The greatest loss that occurred in the gas-engine was in the heating of the water in the jacket; but this was not always a total loss, because in many cases hot water was required on the premises, and might be used for heating purposes or otherwise. He did not say that gas was an economical fuel compared with coal; still it would not be a complete loss, and might be made to circulate, where drying or heating was necessary. He had no doubt whatever that some ingenious mechanic—possibly Mr. Donkin—would find a way by which some vapour might be generated from this water-jacket, so as to increase the economy of the present gas-engine. He was surprised to find it stated that accidents were more common with gas than with steam engines; and he thought the question of boilers must have been left out. He did not recollect any loss of life being caused by a gas-engine; nor did he think it could possibly occur with it more than with any other machine which had rapidly revolving parts. Of course, if it were not guarded, any man might put his head between the revolving arms of the fly-wheel, and would probably suffer for it. But he had never known of such a case; and he could not understand how there could be greater danger with a gas-engine than with a steam-engine. With regard to Dowson gas, very probably further experience was required; but he was much afraid, from the mode of generation, that the purification of the gas was not sufficient, and that there was a great probability that sulphur vapours would be carried forward, which would be injurious, and still more that some very fine dusty matter would be conveyed into the engine, and militate very much against the preservation both of the

* See Journal, Vol. XLV., p. 1229.

cylinder and of the valves. He would give Mr. Dowson every credit for the economy he had effected; but this was one of the things to be provided for. When the gas-engine was first introduced, he was appealed to for advice by some of his friends; and he was very cautious indeed about giving it. To tell the truth, he was afraid that the wear and tear of a machine working at so high a temperature would be very heavy. They had not had then the experience, since obtained, of the use of mineral oils, and of their withstanding these high temperatures, which now permitted great economy to be effected even in steam-engines; and he found that at present the wear and tear of gas-engines was extremely small. The valves would not wear for a long time under the modern system, and a new lining of the cylinder would cost only 2½ per cent. on the original cost. If this were spread over a period of fourteen years, it became almost infinitesimal. They were much indebted to Mr. Donkin for his paper, though he (Mr. Lane) thought that he viewed the question rather through rose-coloured spectacles when he was looking at the steam-engine.

Mr. J. Stelfox (Belfast) said it was well to mention, as a matter of fact, that Professor Kennedy had recommended the use of a gas-engine for the electric-lighting installation at Belfast, to be worked with town gas; and the order had actually been given for it.

Mr. W. H. Y. Webber said he should much like to ask a question of Mr. Bell, who had made a statement which struck him as being very important. He said that he had "gone one better" than the Winterthur people in selling 15-candle gas in the daytime at 2s. 3d., and 18-candle gas in the evening at 2s. 9d. per 1000 cubic feet. He brought out the rather important point that it cost 2d. per candle to put this difference into the gas; and he said the arrangement was giving universal satisaction. He (Mr. Webber) would like to know whether the people were more satisfied with the 15 or the 18 candle gas, and whether they would not be still better pleased if the whole of the gas was made of 15-candle power, and supplied at 2s. 3d.

Mr. Bell said he thought this question would be more properly discussed on the following day, when the subject of the enrichment of gas came before them.

Mr. A. J. Edwards (Taunton) remarked that the paper would be a very valuable one for reference; and he suggested that Mr. Donkin should add to it a statement of the efficiency of the gas-engine, giving the quantity of heat lost through the cylinder and the waste gases.

Mr. C. C. Carpenter (Vauxhall) said they had had in use for some time a gas-engine of 16-horse power, with a starter, both supplied by Messrs. Crossley; and it worked admirably. They could now start the engine with one man only, and with something less than two-thirds of the total load. The adoption of this contrivance had overcome one of the greatest objections hitherto existing to the use of gas-engines. Another point was that a gas-engine worked most economically at full load; whereas he believed a steam-engine worked most economically at perhaps half its load. If this was so, it was perhaps an important matter to consider in comparing the efficiency of the two.

Mr. Denny Lane said he forgot to mention one act which he thought he had proved conclusively—that it took only 1-horse power to transmit 3000-horse power one mile by ordinary town-main gas.

The President having thanked Mr. Donkin officially for his paper,

Mr. Donkin, in replying, said he had done his best to make a fair comparison between the two motors, apart from any bias. Mr. Bell had asked in what sized gas-engine it was best to begin using generator gas. That was a point on which there would be a good deal of difference of opinion. Perhaps 12-horse power was rather low; but different makers varied considerably in their views. It depended on the local cost of fuel and gas in the town under consideration. With regard to the price of gas-engines and steam-engines, the cost of the boiler, chimneys, and fixing had been excluded. This should have been added in the paper. Another gentleman asked whether it would be better to apply steam-jacketing to a steam-engine cylinder, or use superheated steam. Very much would depend upon the local conditions—whether there was any waste heat available, &c. It would be very easy to steam-jacket the cylinder; but this was a question it was difficult to generalize upon. The particular type of engine, the horse power, the speed, and whether condensing or non-condensing, all had to be considered. As a general rule, superheating would be more expensive unless there was a great deal of waste heat that was available. With regard to the use of gas as a motive power for tramcars, he believed there was a car still at work daily at Rotherhithe, being driven by a gas-engine on the Connelly system. He understood that the store of gas was supplied at each end of the journey.

Mr. Denny Lane (interposing) said in the German system the gas was compressed into cylinders at the charging-station, under a pressure of 8 or 10 atmospheres, and was then put into strong tubes placed below the tramcars. The pressure dropped to about 6 atmospheres after a time; and, in general, they would run for about 6 miles without re-charging, or they could be re-charged on the return to the station.

Mr. Donkin said the application of steam for driving tramcars was not exactly the question before them; but it was being done in Paris with considerable advantage. They were using superheated steam, and employing a little steam-engine fixed on one of the ordinary cars; and not on a separate motor or locomotive. It was a new departure; and from inquiries he made last Easter in Paris, it appeared to be running satisfactorily, and the working cost of fuel, &c., as compared with horses, was about one-half. He was much obliged to Mr. Lane for his kind remarks; but when he spoke of small steam-engines consuming 18 lbs. of fuel per horse-power-hour, it was rather an old tale. Of course, if one took uneconomical and small steam-engines, one must take uneconomical and small gas-engines to compare them with. In reply to another speaker, he said the loss in waste exhaust gases from an average gas-engine, if he remembered rightly, was about 35 per cent. About 40 per cent. went away through the walls. It was rather interesting to work out the number of thermal units per square foot which passed through the cast-iron circular walls and into the water in the jacket. Mr. Carpenter had asked whether a steam-engine working at half load did not compare with a gas-engine working at full load. He (Mr. Donkin) thought the best rate of expansion a given steam-engine would work on would depend considerably upon whether or not it was steam-jacketed. In one engine, one might expand many times economically, and in another it would be impossible. So much depended upon the temperature of the cylinder walls. Raising their temperature was always economical—say, by steam-jackets.

A COMPARISON—STOKING MACHINERY OR INCLINED RETORTS.

By Frank Livesey.

Though many and continuous attempts to introduce machinery for retort charging and drawing have been made in years past, very little success could be claimed until an impetus was given by changing from the two to the three shift system of working, by which the amount of work done per man was considerably reduced, while the wages remained the same. The saving in cost was small, and the capital expenditure to effect this saving was considerable; and, in consequence of many defects, every machine erected was different to its predecessor. They were exceedingly heavy and cumbrous, and naturally did not have a good reception in the retort-house. It was considered that steam was the only suitable power. Consequently a heavy boiler, with its complement of water, had to be propelled along the stage; while the work done was unsatisfactory, and there was little saving of time. The circumstances are now quite changed; for, supposing sufficient work for the machine, there is no longer any doubt as to the saving to be effected in carbonizing wages, or any question as to the distribution of the coals. The point now to be decided is which is the better plan or machine to do the work.

Machinery does not seem to be in its proper home in a retort-house; for, if coal dust does no harm, the same cannot be said of coke grit floating about. When, therefore, the system of carbonizing in inclined retorts was introduced—perhaps more correctly speaking, re-introduced—there was a fascination about the plan which attracted many experienced men. Coal is generally delivered in the retort-houses some 15 to 20 feet above the

working floor; being in many cases lifted to this level. For the inclined system, possibly a few more feet lift is necessary to deliver the coals into a hopper; after which they require no further handling, except to check their downward course through shoots and retorts to the coke-hole below. Surely such a method can be worked with a minimum of labour. With machinery, the coal must also be elevated; and it is then put into the retorts by a powerful apparatus, which has to carry several charges of coal about with it, and is consequently a somewhat heavy and clumsy machine. The coke is drawn out with a rake that works like the piston of a steam-engine, instead of having the many and combined motions of a man's hand and wrist, by which the rake can be put into any position in the retorts. The coal and coke are both moved into and drawn out of the retort by mechanical means; whereas in the inclined system, it is only lifted a few feet higher and allowed to fall out, which, however, does not always take place. The comparison seems, on these grounds, in favour of gravitation as compared with machinery; but, to fully investigate the matter, it will be necessary to ascertain the capital expenditure, in order to fix the interest thereon, the cost of maintenance, and finally the carbonizing wages.

To arrive at the capital required, it will be necessary to decide what amount of work a set of machines is capable of doing per diem per shift. The machines of Messrs. Foulis and Arrol, and those made by West's Gas Improvement Company, are both equal to charging 900 mouthpieces in 24 hours, or 75 charges every two hours, allowing plenty of time for rest for the men between the charges.

Horizontal retorts can be erected for £52 per 20 feet retort, capable of carbonizing 7 cwt. charges; but say 6½ cwt. as an average. This includes the whole setting—ironwork, brickwork, furnace, and stage floor. Then 225 retorts at £52 = £11,700. The cheapest inclined retorts that have come under the author's cognizance work out at £88 per retort, capable of carbonizing 7 cwt.; so the 209 inclined retorts will carbonize the same amount as 225 horizontals.

209 inclined retorts at £88 each	£18,392
225 horizontal retorts, at £52 each. . . .	11,700
A difference of . . .	£6,692

This is considerably more than is required for the most expensive machinery.

It will not be erring in favour of machinery to take the cost of a complete installation at £4200, including everything.

5 per cent. interest on this will amount to	£210
5 per cent. depreciation should also be allowed; but as the machines can only be supposed to be working half the year, 2½ per cent. only is charged.	105
Fixed charges on the machines per annum	315

The extra cost of inclined retorts to do the same work is £6692. Allowing 5 per cent. for interest on this excess, and 2½ per cent. depreciation, as with the machines (though it is very doubtful whether the arches will have a twenty years' life), the annual charge will be £501.

Now 225 retorts at a 6½-cwt. charge, four charges per diem, during 26 weeks, at 6½-days per week, will carbonize 49,426 tons per annum. The charges for interest will therefore amount in the case of machinery to 1·53d. per ton, and in the case of inclined retorts to 2·43d., which items must be added to the carbonizing figures. To make a true comparison of carbonizing wages, the rates and conditions must be the same. For instance, it would be misleading to compare London figures with those in vogue at Coventry.

In the following figures, all charges to carbonizing are given—everything being charged from the time when the coals are put into stores until after the coke is slaked; in both cases, foremen, stokers, engine men, firemen, exhauster and boiler men, coal wheelers, &c. They are—

	For Machinery. Per Ton.		For Inclined Retorts. Per Ton.
Carbonizing wages	18·80d.	..	20·50d.
Interest and depreciation. . .	1·53	..	2·43
Oil, waste, and daily repairs . .	1·87	..	0·25
	22·20d.	..	23·18d.

Now take Mr. Winstanley's figures, as published in the JOURNAL OF GAS LIGHTING [May 23, 1893, p. 928], the carbonizing wages are given as 18d. per ton; and the cost per retort was £90. But as this does not include hydraulic main, arch and dip pipes, and other small items, £95 would not be an excessive figure to take. Repairs of tools must also be included. In this case, 195 inclined retorts would do the same amount of work as the 225 horizontals. Then 195 retorts at £95 = £18,525; the excess of cost over horizontals being £6825, which is about the same as the former case, so the figures will stand thus:—

	Per Ton.
Carbonizing wages	18·00d.
Interest on excess of cost over horizontals	2·47
Tools, mouthpiece-stoppers	0·25
	20·72d.

In this case, however, it is uncertain if all the same charges are included as in the first comparison.

These figures, excluding the latter, as the Coventry rates would be lower, show the advantage on the side of machinery. But it would only be so when the machines are working nearly up to their maximum quantity; and the inclined retorts would have the advantage when the number was reduced to (say) one-half. Stoking machinery will be improved and cheapened, there is little doubt; and it has this advantage, too, that the existing arches can be utilized, and in many cases the retorts also. On the other hand, for inclined retorts everything must be taken down, new foundations added, and arches rebuilt, at a large increase of expenditure. But here again means will, in time, be found of reducing the cost, especially the labour, which is a very heavy charge. In the setting, fire-blocks to fit the retorts could be used when the angle is settled, and other methods or alterations adopted to diminish this item.

It is now necessary to consider the alleged objections in regard to carbonizing by the gravitation method. The more serious accusations are: That the gas is of lower quality, and that the retorts will have a shorter life; there is some suspicion also that the quantity made per ton is less, and that the charges are irregular in thickness. The only reason for gas of lower quality being made by inclined retorts is that, having one ascension-pipe for 15 or 20 feet, as the case may be, the gas has to travel a longer distance against the heated sides of the retort, which would not tend to improve the quality. A fortnight's trial at the Greenwich works when inclined retorts only were working did not prove this, as the average quality was the same. On the same occasion, though the quantity of gas made was certainly not increased, it would be difficult to say positively that it was less, as a change in the quality of coals might cause greater variation.

That the retort will have a shorter life seems probable, especially if high heats are worked. This much, however, is certain, that when the retorts are burnt out, they will have to be replaced at a considerably greater cost than the ordinary horizontals, for which no allowance has been made in the figures given for the cost of working. It is stated that, when the coal varies to any considerable extent in size between the extremes of all dust and all lumps, there are irregularities in the thickness of the charge. Difficulties have undoubtedly arisen; showing that some arrangement for checking the speed of charging is necessary on the lines adopted by Mr. Braidwood.

So far in the comparison it appears that the work can be done as well in the sloping retort as in the horizontal, but that there is no saving in wages over good power machines—rather a loss, in fact. There is, however, an advantage claimed for the inclined system, which is that a greater quantity of coal can be carbonized upon the same area of ground. Mr. Winstanley states that he will be able to carbonize 200 tons in a retort-house 72 ft. 6 in. wide by 129 feet long, giving an area of 9352 feet, or 46·7 square feet of roof area per ton per day. Now, if retorts are set in tens, five rows high, taking a charge of 6½ cwt., it is quite possible to work a machine in a retort-house having 48 superficial feet per ton; and if 6¾-cwt. charges are employed, it can be done for 46 superficial feet per ton. Such a retort-house would have a coke-hole that could be used as a store—the coke being sold directly from it; whereas this does not seem possible from the Coventry plan, for the coke in the latter place must be moved directly it is drawn, involving greater cost than by the former arrangement.

Against the machines also there is something to be said, for they cannot be kept in order without small repairs being required; and it is not every works that has a

machine-shop to do this work, as it ought to be done, on the premises. It is rather a serious matter to have a breakdown on machines charging retorts, two-fifths of which are quite out of the reach of hand charging. When working under such circumstances, it seemed prudent to have a stage at hand to take the place of the machines. Accordingly, a temporary stage was provided; but, after lying idle for more than two seasons, it was removed. In one case, machines have worked continuously for three years with one month's intermission. The breakdowns that do occur are small matters, and, as duplicates are kept, the broken parts are soon restored. The working of a power stoker is certainly less laborious than either hand work or the gravitation system, as the men are never exposed to any great heat; while the mental effort is small compared to that (say) of driving a steam-crane.

The comparison here given is based upon the information (which is perhaps somewhat insufficient) regarding the inclined system. It is chiefly from personal experience of the working, but does not cover so long a period as could be wished. Further improvements may alter the present relative position of the two systems; but the investigation of the subject has confirmed the author in his opinion that, given sufficient work, power machinery has the advantage over inclined retorts.

FOULIS-ARROL STOKING MACHINERY AT EAST GREENWICH.

By Joseph Tysoe.

It will probably not be disputed that the general employment of mechanical methods of conducting the operations of a retort-house, does not increase commensurately with the dissemination of facts and figures in demonstration of the great economy that can be effected thereby. The recorded "Transactions" of the various Associations connected with the gas industry give authentic evidence of the saving resulting from the employment of both hand and power machines. That they are not more widely adopted is probably due, in a great measure, to the possibilities of the future, especially as regards the inclined retort system. As to the present position of the inclined retort, its superiority to the best form of power machine has yet to be demonstrated.

The most recent form of retort charging and drawing machinery is in operation at East Greenwich; and the author, being invited by the Council of the Institution to bring the subject before the members, proposes to give a description of these machines, and a statement of the results achieved by them at the works under his charge. The drawing-machine is the design of Mr. William Foulis, of Glasgow, and is no doubt well known to many of the members. The charger is the joint production of Sir William Arrol and Mr. Foulis. The firm of Sir William Arrol and Co. are the sole makers of both machines.*

For the purpose of this paper, careful observations have been made, and accurate particulars have been recorded of the cost of working; so that the figures given may be accepted as showing beyond question the amount of saving that may be effected by the substitution of mechanical appliances of the type described for hand labour in the retort-house. So much has been written and said on the subject of stoking machinery generally, that it would appear hopeless to attempt to add anything new; but, inasmuch as the machines in question are representative of the most modern type of appliances of the kind, a plain statement of facts and personal experiences may be in some degree acceptable.

The author's experience dates from the winter of 1892, when two of the Foulis hydraulic rakes were started at East Greenwich. At that time the chargers had not been constructed, so that the retorts had to be charged by hand—the men charging double the number of retorts that they had previously drawn and charged. As not unfrequently happens when new machinery is introduced in a retort-house, all did not go smoothly at first. It had been predicted by some that the rakes would never be capable of dealing effectively with coke from Durham coal; and it appeared to be just within the bounds of possibility that the prediction would be fulfilled. As many as twenty-two strokes were required to empty a retort, which, in addition to loss of time, was an enormous waste of power and consequent expense. At the works in Glasgow, where the machines were originally employed, the coke is small and soft, and is withdrawn in three or four strokes. Various alterations were made to meet the altered condition of things, chief of which was the substitution of a hydraulic ram of slightly increased diameter; and success was very shortly attained.

At East Greenwich, the arrangement of retorts in one respect is not well adapted for machinery. The settings all consist of ten retorts, five tiers in height, which, though an excellent arrangement generally, necessitates the employment of very high machines, with increased weight and cost, and other attendant disadvantages—not the least of which is the extra power required to move them. They, however, compare very favourably with other machines in this respect. The drawer weighs 2 tons; and the charger (with the hopper empty), 6½ tons—other power machines considerably exceeding these weights.

The rake is composed of a steel bar of H section, on the under side of which works a slide, to which is attached a steel rake-rod. On the upper side of the bar are fixed two 1¾ inch diameter hydraulic rams, each with a stroke of 6 ft. 6 in.; one for the purpose of propelling the rake into the retort, the other for withdrawing it. A 1-inch circumference steel-wire rope passes from a fixed point round a sheave on the end of each ram on to the slide, to give the required motion; the stroke of the rake being double that of the ram. The rake is suspended, about the middle of its length, by a steel wire rope connected with a vertical ram, by means of which it is raised and lowered to suit the varying height of the retorts. The working of one lever performs the four successive operations of raising, propelling, lowering, and withdrawing the rake; and a second lever, in connection with the vertical ram, raises and lowers the rake-bar. The whole is fixed within a light angle-iron framework, carried upon travelling wheels running on rails laid to a gauge of 7 ft. 7 in., and is easily propelled along the stage by one man, by means of bevel-gearing.

The water from the cylinders is conveyed, after being used, into a tank fixed at the top of the framing, from which the quantity required for cooling the rake-head is drawn. The quantity can be regulated by the driver; the remainder overflowing by a separate pipe on to the floor below.

In many works where the large outlay necessary for a complete stoking plant (including coal-breakers and elevators) would be prohibitory, the employment of the rake alone might be worth consideration, more especially where hydraulic power is available.

The charging-machine is somewhat similar in appearance and general construction to the rake; the main points of difference being the addition of a hopper for carrying, and the arrangements for delivering the coal. The hopper is a fixture in the front and on top of the machine; and it will hold sufficient coal for charging twenty retorts. The hopper is filled, as required, by a stationary overhead hopper, which is supplied by an elevator from the stores; the coal previously passing through a breaker. The elevator and breaker are driven by a 9-horse power gas-engine. The coal is delivered into the retorts by a series of pushes, effected by means of a rod with a plate at the end, connected to two hydraulic rams, as in the case of the rake, and worked in precisely the same manner as the rake; the only difference being that the push-plate is of a different shape, and rather larger than the rake-head. The charge of coal is delivered in front of this plate by means of a revolving drum, fixed immediately under the hopper, and divided by radial partitions into a number of chambers. This drum has a continuous rotary motion imparted to it by the action of two small hydraulic rams, by means of a ratchet-and-pawl arrangement; the extent of the revolution of the drum determining the amount of coal discharged therefrom. This can be easily regulated to the amount required for the charge.

The connection between the machines and the mouthpiece of the retort is effected by a sliding plate, with shallow sides to it, controlled by the driver from the platform on which he stands; the plate being so constructed as to enter the mouthpiece about 2 inches. The plate receives the coal as it falls from the drum. It will be evident that, in charging a retort, each stroke of the pusher must be shorter than the preceding one; and, in order to

* The general arrangements of these machines have already been illustrated and described in the Journal. (See Vol. LVIII., p. 895; and Vol. LX., pp. 555-6.)

automatically effect this shortening of the stroke, there is provided a revolving shaft, placed parallel with the charging ram, having fixed upon it at equal distances six stops or projections, placed radially out of line. The shaft being given a sixth of a turn by a ratchet-and-pawl arrangement actuated by the lever which works the pusher, brings the stops successively in the path of the ram, and shortens the stroke each time 16½ inches, until the seventh stroke, when the charge is complete. If it be desirable to miss the last stroke, by reason of the mouthpiece of any retort being dull, the driver can operate the revolving shaft by means of a hand-wheel attached thereto, and bring it into position for making the first long stroke for the next retort.

The pusher with all its attachments, including a platform for the driver, is suspended, raised, and lowered in the same manner as the rake-bar previously described. As with the rake, the movement of one lever communicating with the valves suffices for all the operations of charging the retort, with the exception of the adjustment of the sliding-plate into the mouthpiece, which is worked independently by hand.

The hydraulic power is supplied by a duplex high-pressure pumping-engine, driving direct four single-acting plunger pumps, 3½ inches diameter, with 16-inch stroke, working into an accumulator with an 11-inch cylinder, weighted to give a pressure of 400 lbs. to the square inch. The pressure is conveyed along each side of the retort-house in 1½-inch bore lap-welded tubes, tested to 1000 lbs. These tubes are carried under the stage-floor; and at suitable intervals, stand-pipes, terminating with a valve and a special hose connector, are carried up through the floor to a convenient height for the attachment of the hose pipes carried by the machines.

Originally these stand-pipes were fewer in number, and carried up into the roof; and a long flexible hose was permanently attached to each. But it was found more convenient and economical to shorten both stand-pipe and hose; increase the number of the former; and make the latter a fixture on the machines. The hose pipes, being specially made to withstand a heavy pressure, are rather costly; and the reduction of the expense by the new arrangement is considerable. Another improvement affecting the durability of the hose, was the introduction by the author of a back-pressure valve at the end, close to its attachment to the stand-pipe, the effect of which is to keep the pressure constantly on the machines, and thus avoid the ill-effects that would arise from a sudden pressure, when a transfer is made from one stand-pipe to another.

As regards the amount of water required for the machines, it is found that the total amount pumped for one set of machines, working on 200 retorts in 24 hours, is about 33,000 gallons. The theoretical quantity required by calculation is approximately 30,000 gallons; the difference probably being accounted for by leakage from the cocks, glands, and connections on the machines themselves (which it is impossible to altogether avoid), and leaky valves on the pumping-engines. The quantity of water employed per ton of coal carbonized amounts to about 140 gallons. The larger portion of this is taken by the rakes, the waste water from which runs on to the rake head and rod, and down on to the hot coke below, and is thus utilized. By an arrangement of troughs on the walls of the retort-house, the waste water from the charging-machines is run back into the supply tank. At East Greenwich, the question of water supply is of little moment; there being ample provision close at hand, and the only expense connected with it being the pumping. But in localities where water has to be paid for, it would form an appreciable item in the cost of working the machines.

The apparatus in its complete form was ready for work in November last; and a commencement having been made on five beds of retorts, the number was gradually increased (as the men became proficient) to 20 beds, which is the maximum number for one set of machines. As previously stated, the retorts are set in five tiers, and 6-hour charges are adopted. At the first draw of the day, the top three tiers (or 120 retorts) are taken, occupying 2¼ hours. After an interval of half an hour, the remaining two tiers (or 80 retorts) are dealt with, taking 1½ hours, and leaving 1¾ hours before the next draw. The machines are therefore only at work 7½ out of the 12 hours; ample time being given for any repairs that may be necessary, without delaying the work.

The number of men employed upon each set of machines per 24 hours is 30; the wages amounting to £8 19s. or 9·3d. per ton for the 230 tons of coal carbonized. To this must be added 3·2d. for cost of maintenance, fuel, and 10 per cent. for interest and depreciation; making a total of 12·5d. The same number of retorts worked by hand would require 80 men at a cost in wages of £24 12s., or 25·6d. per ton, to which must be added 0·7d., which is approximately the cost of tools used in hand work—giving a total of 26·3d. per ton, and showing a difference of 13·8d. per ton in favour of the machines. These figures do not include all retort-house labour; and a further amount of about 6d. per ton for labour common to both systems must be added to arrive at the total cost of carbonizing.

At present the charger is moved along the stage by hand, necessitating the employment of an extra man. Arrangements are, however, in progress for the application of a system of wire-rope propulsion; the power to be obtained from the gas-engines driving the elevators, as there is sufficient surplus for the purpose. This will reduce the number of men employed to 26, and effect an additional saving of 1d. per ton.

Apart from the direct and ascertainable financial results, there are two characteristics of these machines which give them superiority over the hand method of charging. One is that, when the amount of coal desirable for the charge has been determined, the machines can be so adjusted that it remains constant; the other, that the charge is placed in the retort practically level. The advantages of these two considerations need no demonstration to the members of this Institution.

A Correction.—Towards the close of Mr. W. Hardie's remarks on Mr. H. Lees's paper at the recent meeting of the North of England Association, as reported in the JOURNAL last week (p. 910), he is made to say that "he had seen many small gas-works using as much as 12 tons of coke for a steam-engine." He points out that the words "1200 tons of coals without an exhauster" should have been given in order to convey what was intended.

Death of Mr. Herbert Andrew.—It is with regret that we have to record the death of Mr. Herbert Andrew, the Gas and Water Superintendent of the Oldham Corporation, on the morning of Wednesday, the 9th inst. He was attending to his duties as late as the previous Saturday, although he complained that he felt somewhat unwell. On reaching home, he became worse; and his medical adviser was sent for. Mr. Andrew was found to be suffering from a complication of diseases; but no serious results were then feared. On the Tuesday evening, he was pronounced as being practically out of danger; but unfortunately a relapse set in during the night, resulting in his death. Mr. Andrew entered the service of the Corporation as a clerk in 1860; and he was appointed Superintendent of the Gas and Water Department in 1873, on the death of Mr. James Taylor. Since that time the work of the office has grown at a rapid rate; an idea of this being afforded by the fact that the number of gas consumers has increased from 7000 in 1860 to 44,000. The deceased gentleman, who was in his fiftieth year, leaves a family of nine children, with whom a vote of condolence was passed, on the day of the sad event, at a joint meeting of the Gas and Water Committees.

Trial of Incandescent Gas-Lights for Public Lighting at Winchester.—For some time past, the Manager of the Winchester Water and Gas Company (Mr. F. G. Dexter) has had a complete street, as well as a number of independent lamps at various levels and in different positions in the city, lighted by means of incandescent gas-burners, with the view of demonstrating their adaptability for outdoor illumination. Our readers may remember that Winchester is one of the towns usually cited, by advocates of oil lighting, as a place where the system has been "successfully" adopted. We will not venture to say how far they may be correct in the use of the word. At any rate, oil-lamps have held their own there for something like fifteen years; and the only system which seems likely to be able to compete with them in point of cost is the one now on trial. We learn from a local paper that "the new illuminant sheds a glow of clear bright light—presenting a remarkable contrast to the sickly yellow flame of the oil-lamps close by;" and the writer adds that even a gas-burner of 140-candle power in the centre of a road "paled in comparison." Mr. Dexter has displayed considerable enterprise in this matter; for we do not, for the moment, remember any other town in England where the incandescent gas-light has been employed on so large a scale, or with a definite purpose. In Winchester, there is only one opinion as to the improvement in the lighting; and whether or not "new lamps" will be exchanged for the "old ones" will depend upon the cost.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 975.)

THE intervention of the Whitsun holidays has brought about no change in the general position of the Stock Markets. Things were just as much depressed last week as they were in the preceding week; and the same adverse influences are still in operation. Consequently, at present there is no seeing the way to a chance of amendment for some time to come. The worst is in the Western world—the United States and South American markets being the centre of depression. Silver is worse; and the Indian exchange has fallen still lower. As usual in such a state of affairs, the gilt-edged securities are more in request than ever; and the prices attained by the choicest appear extravagantly high. High as they are, however, the outlook points to the probability of their rising still higher. The Money Market remains unchanged, and is not likely to harden. Business in the Gas Market has been rather quiet all the week, and is firm generally. Several issues show more or less considerable advances in price; the only noteworthy exception being Gaslight "A," which has made a further fall. Transactions were not very extensive, and it lacked support; opening fairly steady at 229, and falling away gradually to 226½ on Friday, with a nominal abatement of 2 in the quotation. The demand for high-class investments, on the other hand, advanced the value of the 4 per cent. debenture and 4 per cent. limited stocks. Very little business was marked in South Metropolitans; but the "B" stock took a jump up of 5, and marked the top price on Saturday—probably on the strength of the announced reduction. Commercials were not dealt in at all. There was more animation among the Suburban and Provincial division—Brighton and Hove being especially active; and two or three of them have improved their quotations. The Continental Companies continue on the rise; Union and Imperial being quoted at a nice advance. None of the rest offer anything calling for remark; and the only variation in price is a fall in Parà. Business in the Water Companies was very quiet; but they continue to mount steadily in value, and some issues have attained prices not hitherto touched.

The daily operations were: Monday being a holiday, the Gas Market reopened on Tuesday, and business was very quiet all day; quotations remaining undisturbed. Water began to rise at once—West Middlesex improving 3; Chelsea and East London, 2 each; and Grand Junction, 1. Transactions continued much restricted on Wednesday; Foreign undertakings having the best of it, with a rise of 2 in Imperial and 1 in Union. Thursday produced some greater show of activity, and several issues changed hands at very good figures; but Gaslight "A" stock was depressed, and receded 2. Parà also fell ½; but Bristol advanced 2. Business fell away somewhat in point of volume on Friday; but the general firmness was exemplified by a rise of 4 in South Metropolitan "B," and of 1 in Gaslight 4 per cent. debenture. On Saturday the same favourable tendency was marked by an advance of 2 in Gaslight "B;" 1 in South Metropolitan "B;" and ½ in Bromley new.

ELECTRIC LIGHTING MEMORANDA.

Central Stations Discredited—The Affairs of the London Electric Supply Corporation—Electric Lighting at a Fancy Price for Winchester.—The Escape of Folkestone.

Is history going to "repeat itself" in the matter of town electric lighting stations; and are the electricians—once the spoilt darlings of the newspapers—to be driven out to the manufacturing suburbs like the gas manufacturers of a past generation? It looks very like it. Our contemporary the *Engineer* has been driven by recent occurrences to erect the parallel between the experiences of the early gas engineers and those of the latter-day central station electricians. When gas lighting was first introduced, works were put down everywhere as nearly as possible in the middle of the districts to be supplied. People rather liked the idea than otherwise; the sight of the gas-works in their midst serving to indicate the fact that the town was keeping abreast of the times. After a while, however, when the novelty had worn off, gas-works were voted a nuisance in all residential and business neighbourhoods; and they were accordingly driven off to the outlying suburbs, there to keep company with the refuse destructor and the coal-yard. So it is coming to be with the town electric lighting station. People did not mind it at first. Never so obtrusively factory-like as a gas-works in appearance, the electric lighting station, with its nicely cut brickwork façade and its slender chimney, had an altogether superior look. It seemed absurd to suspect such an elegant establishment of being a nuisance; but, unfortunately, experience of the electric lighting station in action has not tended to recommend it as a desirable addition to a quiet neighbourhood. So the *Engineer* has sapiently come to the conclusion that the central electric lighting station will have to go the way of the gas-works. It will have to change its name, or stand confessed a misnomer. "Thousands of pounds are spent in trying to get rid of vibration; it is all in vain. The truth is that all such works are out of place in a residential neighbourhood. The sooner existing companies look the facts in the face the better. They may rest assured that the time is rapidly approaching when extramural generating stations will not only be desirable, but absolutely essential." Very true; but what about sinking the cost of the existing stations?

According to the view set forth in the preceding paragraph, Mr. Ferranti was a good deal in the right when he insisted upon establishing the generating station of the London Electric Supply Corporation at Deptford. This truly notable electrical engineer was not altogether in the right, however, in respect of the scale upon which an outlying station of the kind ought to be laid out; and consequently the undertaking which he engineered with so much daring has been in trouble from the outset. The speech of the Chairman of the Company, Mr. J. S. Forbes, at the recent annual general meeting, was a masterpiece. He has admitted, on previous occasions of the kind, that Mr. Ferranti was not justified by the results of his tremendous experiment; but he is coming round to admit that, like Brunel in the railway world, Ferranti failed mainly through being ahead of his time. Whether the Company will be able to live to see Ferranti's dreams realized, is yet doubtful; but it is claimed by the Board that last year the undertaking held its own, and that the conditions of commercial success, if not yet realized, are at least within sight. We have always regarded the Company's designs with admiration, if not with confidence; and we can only hope, in the interest of British engineering enterprise, that the Deptford concern will not sink under its financial troubles while a stone remains unturned in its arduous pathway to success. In any event, the Company's history will be a most interesting chapter in the chronicle of the introduction of electric lighting into London upon the grand scale.

We have received from a correspondent some interesting information respecting the development of the project for conferring the benefits of central station electric lighting upon the ancient city of Winchester. As in so many other places throughout the kingdom, the impossibility of raising private capital for any venture of the kind has driven the electricians to the expedient of trying to persuade the citizens of the old Wessex capital that they ought to tax themselves for the purpose of bringing this triumph of material civilization into the town. The Brush Company seem to have gained the ear of the Corporation with a plausible scheme; and recently Mr. J. Raworth, the Engineer of this Company, visited the city with the object of delivering a popular lecture upon the subject, in the course of which he committed the indiscretion of saying that "he could undertake to *give* an electric light at a lower price than gas at 2s. 6d. per 1000 cubic feet." The italics are ours. Doubtless the Brush Company could give electric lighting for a time at a considerably lower figure; indeed, while they were about it, it seems a pity to spoil the graciousness of the offer by attaching any consideration of repayment to it. Why not give electric lighting for nothing? It is unwise, as the proverb says, to look a gift horse in the mouth; and if Winchester can get electric lighting upon Mr. Raworth's terms, we advise the Corporation to close with him at once. What we do say, however, is that not Mr. Raworth or anybody else can sell electric light at a profit for anything like this figure. If he thinks he can do it, he need not go away from London to get a heavy contract at the price.

It is with a particular degree of pleasure that we can record the satisfactory termination of the electric light agitation at Folkestone. Thanks to the energy, pertinacity, and undeniable arguments of Mr. Councillor Baker, referred to in this column on the 24th ult., the Town Council have come to see the pitfall prepared for them, and have rescinded their resolution to spend the ratepayers' money in the manner they originally intended. This prudence on the part of the Folkestone Corporation will, we hope, find imitators elsewhere. It needs no small degree of moral courage for an average town councillor to decline to support an electric lighting scheme advocated with clever reference to the desirability of his beloved town keeping well abreast of the times. But the trick has been worked too often; and municipalities are growing shyer of the electrical tempters. Folkestone is to be congratulated upon its escape.

THE PLANNING AND LIGHTING OF THE MODERN HOUSE.

THE members of the Architectural Association had a treat at a recent meeting, when a paper by Mr. R. A. Briggs on "Modern House Planning" was read and discussed. This is a subject which has been frequently treated in these columns from the point of view of the gas engineer; but no excuse is needed for recurring to it in connection with the suggestive paper of Mr. Briggs, which is published in full in the *Builder* of the 5th inst. The planning of a dwelling-house may be considered from various aspects—as the artistic, the utilitarian, the sanitary, and so on; and no study of the subject is to be regarded as complete which does not take account of all of these standpoints for criticism, which, in point of fact, merge into one another. Bearing in mind the requirements which a successfully planned modern house must fulfil, both as regards its character as a unit in the aggregate of domiciles in which a community is housed, and as the outer husk, or clothing, of the inmate, it must be conceded that complete success in planning is not easy

of attainment. It is therefore profoundly interesting to observe how experienced architects attack such problems when they are presented to them; and we shall not go wrong in regarding Mr. Briggs as a good example of an important order of practitioners in this line, with a speciality in the description of suburban residences which are usually good customers of gas companies.

There is a fundamental difference between the conditions under which town and suburban or country houses are planned, which only needs to be mentioned to assert itself with all its due importance. The aspect, the dimensions, and to some extent the general style and arrangement of the former, are usually determined by its class and situation; so that the architect has not nearly so free a hand, nor the owner so wide a choice, as they have when the house stands alone. Again, it will hardly be disputed that the community at large has a very definite interest in the fashion in which its individual components are housed; but this interest is not altogether the same in the cases of town and country or even suburban houses. Whether consciously or unconsciously, the first thing to be thought of by an architect and his client in regard to a project of house building, is how the house will look when finished. The intending householder identifies himself in the first place with the public, inasmuch as he does not dream of outraging by his building operations the common taste and sense in such matters; and it is the architect's first duty to reconcile his client's individual wants and predilections with the possibilities of the time and the place. This observation appears sufficiently trite; but we do not think that architects, who, by reason of their superior knowledge, should lead their clients' opinions in this regard, give always the clear indication of having realized the principle which could be desired. The town house, for example, is much more a concern of the community than a suburban or a country house. It is no more to the occupier, who can but live and enjoy himself in his house, wherever it may be situated; but bearing in mind how much more civilized, so to speak, is town life as compared with the freer country life, we hardly find this difference sufficiently emphasized in the design and fitting of town houses. Take the one point of smoky chimneys. We perceive how much dignity the massive chimney-stack lends to the manor house; and the "smoke that so gracefully curled" from a cottage chimney has been celebrated in familiar poetry. But the town chimney is a great nuisance, that architects are not half solicitous enough to do away with.

It is not fair, however, to make too much of the smoke nuisance of towns by way of commenting upon Mr. Briggs's paper, which, as already remarked, deals mainly with the responsibility of the architect who is not troubled overmuch with considerations of aërial sanitation. He begins by slightly disappointing us; for, having to mention the need for ascertaining the client's taste in building, Mr. Briggs observes that upon the answer to the question whether the gentleman has a preference for "the old manor house style," with mullions and half-timber work, or for square rooms, will depend the character of the whole building. Apparently there is no other choice than between "manor house style," and "eighteenth century." Alas! Is domestic architecture dead too; and is the creation of a nineteenth century house as far beyond the powers of our architects as the designing of a modern church?

We do not propose to follow Mr. Briggs through all his observations about house planning, but only to comment upon a few of his most important hints, and to supplement what he has to say on the subject of natural lighting with a few suggestions respecting the artificial lighting. It is to be accounted to him for virtue that he insists upon the advantage of a good entrance, porch, vestibule, and hall; the latter capable of being used as a room, with all the principal ground-floor apartments opening into it, and the staircase rising out of it. This is ideal planning; and the pity is that there is not more opportunity for it. As Mr. Briggs says, a central hall saves passages, which are waste; and the hall fire keeps the whole house warm in winter. In the arrangement of the lights, care should be taken to avoid the casting of deep shadows near the entrance door; while a sufficient, but not necessarily a very brilliant light, should indicate the position of the door at night. The hall itself can hardly be too well lit, because this gives the effect of cheerfulness, and imparts a hospitable appearance to the whole house. There is nothing more chilling and depressing than a gloomy entrance hall. It is best lit by a pendant lamp, so as to keep the floor clear, and avoid interference with the wall decoration; but the lamp should have branches for any hall that has pretensions to be more than a passage.

Next to the entrance, Mr. Briggs considers the kitchen, the pantry, and the general service arrangements. This is as it should be; for, as the experienced author observes, such seemingly little matters as the right placing of a housemaid's closet are the soul of good house planning. It is sagely remarked that the position of the range is to be seriously considered, with a view to the twofold requirements that it shall have a good light upon it, and that the odours of cooking shall not be wafted through the house. The former is, in practice, more certain of attainment than the latter; for light can be depended upon as the result of the proper placing of a window and a gas-burner, but who shall prescribe the course of the smell of steak and onions? It is a pity that Mr. Briggs did not spare a few words to define the situation of that indispensable adjunct to the kitchen range—the gas cooking-stove. Our own impression is that room should be found for this appliance, preferably in the scullery; and that, unless unavoidably, it should not be fixed in the kitchen itself. Many architects provide for a fire-grate in the scullery, which is practically useless. It is preferable to enlarge this fireplace to make it take a full-sized gas kitchener; and the chimney then serves to keep the frequently unpleasant smell of this appliance from entering even the kitchen.

On the subject of the dining-room, Mr. Briggs is decidedly sound. He insists upon its being a parallelogram on plan; and also, among other things, that it shall have such a disposition of the natural lights that nobody need sit in his own while at table. Upon this head he says: "I think the best arrangement for lighting a dining-room is to put the windows on the long side of the wall, and an extra subsidiary window in the end wall." But, strangely enough, the architect omits to mention the fact that since a dining-room is used by artificial light for the principal meal during the greater part of the year, the disposition of the artificial lights in such an apartment is at least as worthy of consideration as the arrangement of the windows. It seems almost superfluous to insist upon the necessity for good light upon the dining-table; but, as a matter of fact, architects rarely make proper provision for this. On all accounts a ventilating regenerative gas-lamp is the best means of lighting a dining-table; but, in order that this shall be available for the purpose, it is essential for the architect to make the proper structural provision for it. This concentrated lighting should be supplemented in a large room by wall brackets by the fireplace, and perhaps also elsewhere, with the object of breaking up shadows. Until architects can be persuaded that, though their most modern ideas in house design date from the last century, a good deal in the way of lighting methods has happened since then, it will be hopeless to expect them to make things pleasant for such mushroom growths as gas or even electric lighting. Yet it might be thought that the bare idea of having his dear panels and mouldings cut about after finishing, to accommodate pipes and wires, would so distress the soulful architect that he would be careful to make allowance for such matters in advance. This is a point which Mr. Briggs omits to make; but it should never be lost sight of by architects that the meanest fitting which goes to add to the comfort or convenience of the occupant, is not beneath their provident care. There is nothing shameful about a gas-pipe when in its place; but it is a disgrace to the architect when his design has to be spoilt by the appearance of a gas-pipe or anything else in the guise of an after-thought.

Mr. Briggs names seven points of good house planning, to which he attaches one or two riders; and we take the opportunity of adding thereto the following: Let it be borne in mind that houses are used as much by night as by day, and that consequently the artificial lighting is as important a consideration as the size and disposition of the windows. The architect should come to an understanding with his client about the artificial lighting, which should not be left to chance. If only portable lights are to be used, such as lamps and candles, the architect may be pardoned for not thinking about them—with the exception, possibly, of the arrangements for lighting the hall and ball-room. We mention this, because pendant lamps call for a suitable adaptation of the ceilings from which they are hung. If, on the contrary, either gas or electric lighting is to be adopted, the architect ought to know how to make the necessary provision. Yet how often is the lighting of a dressing-room intelligently arranged? Attention should be given also to the lighting of the kitchen and service apartments, and to the corridors, staircases, retiring-rooms, &c. Wherever gas can be had, it should be applied to facilitate the getting about in, and doing the work of, a house during the dark winter days; and to this the architect should see. Whatever may be the occupant's taste in regard to the lighting of the drawing-room, or even of the dining-room, there can be no questioning the superiority of gas for the purposes above named, as well as for the hall, vestibule, &c. It may be objected, by some pronounced mediævalists, that gas lighting does not harmonize well with the manorial, or even with the eighteenth century, style of house architecture, with which the art, as a creative force, seems to have ended; but a gas-burner should be at least as much at home in a house of these patterns as a grand piano, and the architect who cannot dispose of a gas-fixture so as to obtain a good effect from it, had better get himself a tie-wig and a sword, and forswear railway travelling and the use of the penny post and telegraph until he is sure of his proper epoch.

A New Ammonia Saturator.—A notable feature at the recent May-day Show at Bolton was a railway lurry bearing upon it a large solid plate lead saturator, weighing some 7 tons, and made by Messrs. Joseph Taylor and Co., of that town, for the Bromley Gas Consumers' Company. The saturator was made from 1½-inch lead plate for the sides and midfeather; 2½-inch plates for the bottom; and 1¾-inch plates for the top. The chief feature of this saturator, which is of new design, is that it was made with only two vertical seams burnt solidly together, without the use of any sand whatever or the oxy-hydrogen blow-pipe. The seams are controlled by the aid of chills; the finish being clean and dense. This is the fifth saturator made by Messrs. Taylor this year.

NOTES.

The Minimum Temperature of Visibility.

Mr. P. L. Gray has recently read a paper before the Physical Society upon the minimum temperature of visibility. The author gave an account of experiments made with the object of ascertaining the lowest temperature at which bright or blackened platinum becomes visible in the dark. The instrument used for the purpose was a Wilson and Gray's modification of Joly's meldometer, in which a thin strip of platinum is heated by an electric current. The conclusions arrived at by Mr. Gray are that the minimum temperature of visibility is the same for a bright polished surface as for one covered with lamp black, although the intensity of radiation may differ with the two surfaces; and that the visible limit at the red end of the spectrum varies greatly for a normal eye, according to its state of preparedness. By resting the eye in complete darkness before taking an observation, a surface may be seen when heated to only 370° C. People's eyes differ somewhat upon the point of the minimum temperature of visibility; but the difference would probably not amount to a great deal if tested under the same conditions as to preparation, &c. Mr. Gray also confirms what has been previously stated as to the colour of surfaces when heated just sufficiently to become visible in the dark. He states that to most observers the strip in his experiments did not appear red at the low temperatures employed to render it visible, but looked like a whitish mist. Inserting a plate of glass or a layer of water in the line of vision had no effect on the temperature of visibility. It has been shown by Captain Abney that all colours appear grey when of small intensity.

The Protection of Timber by Tar.

It is stated that the effect of creosote in protecting timber piling, &c., from the attacks of the teredo and other marine worms, has been found by the Engineers of the New Orleans and Mobile Railroad Company to be exhausted after some years; and a large amount of creosoted timber work has accordingly been protected by a concrete covering. A paper on the subject has been read before the American Society of Civil Engineers by Mr. R. Montfort. The trouble appears to be traceable to the fact that the volatile constituents of the creosote, which are obnoxious to the worms, are washed out of the timber in the course of years, and the solid matters that remain have no protecting value. It is stated however, that if the creosote oil contains a large proportion of naphthalene, it will continue to protect timber so long as the latter constituent remains in the wood. Mr. L. J. Le Conte, commenting upon Mr. Montfort's paper, states that along the Pacific coast timber piling is protected by coating it first with boiled coal tar. Upon this is nailed a good covering of stout felt, saturated with coal tar; and an outside protection of redwood battens or boards, as the case may require, keeps the whole snug. Timber thus treated has lasted for 25 years upon a worm-infested shore, and is as good now as on the day it was put in. Buoys, lighters, &c., are similarly protected.

Poincare on Maxwell's Theory.

M. Poincaré, the renowned French mathematician, has published an article in the *Annuaire* of the Bureau des Longitudes for 1894, upon the teachings of Maxwell and Hertz, which gives a succinct exposition of the various concepts that serve as the bases of the electro-dynamic theory of light. The writer shows how Maxwell established the relations between optical and electrical phenomena; referring the luminous ray to a series of alternating currents produced in dielectrics, or even in the air or the interplanetary vacuum, which changes its direction a thousand billion times every second. The enormous induction due to these frequent alternations produces other currents in the neighbouring parts of the dielectric; and it is thus that the luminous waves spread from point to point. Calculation shows that the rate of the spreading is equal to the ratio of the units—that is to say, to the velocity of light. Hertz followed up Maxwell's theory by a demonstration of the rate of propagation of inductive effects, which was done by the method of interferences. Hertz has, in fact, according to M. Poincaré, realized a veritable synthesis of light, inasmuch as he has obtained a cluster of electrical rays which are capable of reflecting and refracting themselves regularly. If these rays were a million times shorter, they would not differ from light itself. Notwithstanding the success of Hertz, however, M. Poincaré remarks that there yet remain complications and discrepancies to be cleared away before the ground laid out by Maxwell can be fully occupied. He declares that "the identity of light and electricity is from to-day more than a seducing hypothesis. It is a probable truth; but it is not as yet a proved truth."

Sewer Air and Typhoid Infection.

Attention was recently drawn in the JOURNAL to certain examinations of sewer air which pointed to the conclusion that the aërial emanations of sewers may be harmless, if disagreeable. Some further light is thrown upon this subject by an article in *Nature*, descriptive of some experiments by Dr. Alessi, who has not contented himself with finding very few and harmless microbes in sewer air, but has submitted the whole question of its relation to typhoid fever to a searching experimental inquiry. For this purpose, the effect of inhaling sewer air and the gases from putrifying materials was tested on animals which were at the same time inoculated with typhoid germs. It was found that animals breathing sewer air were very much more liable to succumb to mild doses of typhoid infection, than others similarly treated but kept in more sanitary surroundings. It was also ascertained that it was during the first two weeks of exposure to these noxious gases that the animals were most easily predisposed to typhoidal infection. This circumstance is regarded by Dr. Alessi as partly explaining how it is that some people who habitually breathe contaminated air do not appear to suffer any evil results, having gradually, in course of time, become inured to it; while a stranger, exposed to like conditions without previous experience, may suffer severely. The degree of predisposition, moreover, may be expected to vary with different people.

TECHNICAL RECORD.

VISIT OF THE SOUTHERN DISTRICT ASSOCIATION TO MAIDSTONE.

The members of the Southern District Association of Gas Managers are usually fortunate in the arrangement of their summer meetings; but they were exceptionally happy this year in having a cordial invitation to Maidstone, which is one of the good old English county capitals that are much more worth visiting than many a professedly pleasure resort. The President of the Association for the year (Mr. H. Smythe) is Engineer and Manager of the Maidstone Gas Company, in which honourable office he succeeds—and not unworthily—such well-known men as Mr. John West and the late Mr. John Somerville. A goodly number of members of the Association concentrated by different routes upon Maidstone on Friday last, to be welcomed on arrival by Mr. Ambrose Warde, Chairman of the Company, and Mr. Smythe. According to the programme of the day, the first business was luncheon, provided by the hospitality of the Company, and presided over by Mr. Warde, who, in response to the well-deserved complimentary acknowledgment of the kindness of the Directors, gave, in the course of a short address, a few particulars relating to the gas supply of the town, which are deserving of attention. Measured by the standard of bulk, the Maidstone gas-works are not great—the output being not more than 190 million feet annually; but measured by the style in which the work is done, the Maidstone Company need not fear comparison with any. The average make of gas is upwards of 11,000 cubic feet per ton, of which 10,400 cubic feet per ton are sold. The average yield per mouthpiece is 7500 cubic feet per day, with five-hour charges of 300 lbs.; and the average illuminating power is 15·83 candles. Rigid sulphur purification is insisted upon; the average testing for the past year showing no more than 9·51 grains per 100 cubic feet. For the last five years, the price of gas has been 2s. 5d. per 1000 cubic feet; and it was Mr. Warde's boast that the history of the Company contains no example of a rise in price—the course having been uniformly downward. Regenerator firing is in vogue; the Company make their own stoves; there are no bad debts for gas in the town; and automatic prepayment meters are now carrying gas where it never went before. Few towns have such a record of wise progressiveness in gas administration; and none has a better. The present Chairman has filled the post for more than thirty years. He has seen the practical application of mechanical power to gas stoking start from these works and spread over the country; and he retains to this day the open mind and the prudent liberality of opinions that have done so much to place the Maidstone Gas Company in its present position. This explanation, aided by the distribution of copies of a neat plan of the works, fittingly preluded the visit of inspection which the members of the Association paid to the station after lunch. It is only just to Mr. Smythe to state that he amply maintains the standard of efficiency which the honourable history of the Company has established.

From the gas-works the visitors drove in brakes through the pleasant Kentish scenery to Leeds Castle, an old moated country-house dating from Saxon times, and as replete with historical interest as with beauty of structure, situation, and surroundings. The party returned to Maidstone for "high tea," after which a few complimentary speeches were made, and the visitors dispersed in great content with the arrangements which the President and the indefatigable Honorary Secretary (Mr. James W. Helps, of Croydon) had made for their instruction and entertainment.

Royal Society.—Among the candidates for election into the Royal Society who have been selected by the Council as suitable, we notice Mr. Victor Hubert Veley, M.A., F.C.S., of Oxford. Mr. Veley was a few years ago an occasional contributor to our columns; and articles by him have appeared in the Transactions of the learned societies

THE SEPARATION OF WATER FROM TAR.

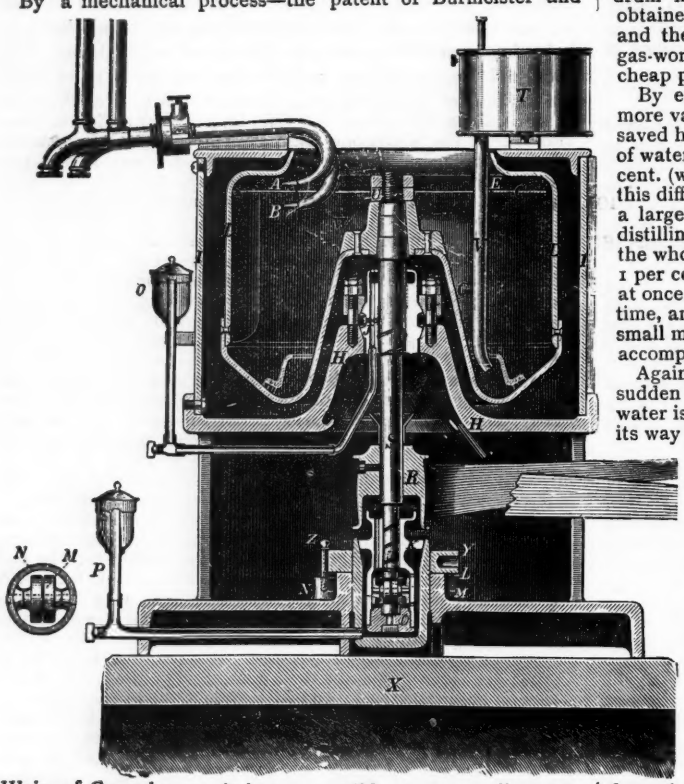
By THEODOR PETERSEN, of Copenhagen and London.

A Paper read before the North of England Gas Managers' Association at Newcastle on Saturday, May 5, 1894.

It will be generally known that in tar, as ordinarily stored in tar-wells, there is 16 per cent., and in some cases even more, water contained in it. This fact is, of course, well known to the tar distillers; and, therefore, when making offers for tar, or when making contracts with gas-works, they bear this in mind, and bid a lower price than they otherwise would if the tar were perfectly free from this water or ammoniacal liquor.

The water has to be partially removed, to make the tar of commercial value either to local consumers or to the large distillers. The old cumbrous method of gravitation will, if enough time be allowed, and if the green tar is agitated from time to time, take the water to the top; so that the tar can be drawn off from the bottom with less water than ordinary in it. But even under the most favourable conditions, the contained water is rarely less than 7 or 8 per cent. When this green tar arrives at the distillers' works, it is placed in tanks and warmed, so as to diminish the viscosity; and then it is again agitated, and left for a short time. In this way, the contained water is reduced to 3½ per cent.; but very rarely indeed is it less in quantity than this.

By a mechanical process—the patent of Burmeister and Wain, of Copenhagen—it is now possible at very small cost to reduce the water to less than 1 per cent.; and this quantity is really chemically-bound moisture, and is impossible to be eliminated, except by distilling. Every vestige of mechanically-bound water is removed almost instantaneously by this method, which has the additional advantage of being so simple that one's only feeling is surprise that nobody has thought of trying it before. It has now been in operation in Copenhagen and in Berlin for the past four years, with (I gather from inquiries) the most pre-eminently satisfactory results; and I take special pleasure in bringing the arrangement before your notice to-day.



I need not go into great detail as to the mechanical construction of the machine. You will observe from the drawing that the operation is performed by a centrifugal machine exactly similar in principle to those which are employed in sugar factories, chemical works, and in steam dairies for the separation of cream from milk. The tar is first warmed (in warm weather this is not necessary) to a temperature of about 92° Fahr., and is then run into the machine through the tube V. The drum D is revolving at a speed of 2000 revolutions per minute, so the green tar impinging against the bottom ring just in front of the opening of the tube is split up by reason of the difference in the specific gravities of tar and ammoniacal liquor. The tar being the heavier is forced downwards and outwards, and takes up a vertical position nearest the periphery of the drum. The ammoniacal liquor takes a vertical position inside of this, nearest the centre of the drum. By a very simple and yet ingenious device, the tar and liquor are then drawn off through different tubes A B. You will notice on the drawing a plate C, near the top of the drum. This has an opening left nearly all round the periphery; and the tar forces its way through this and on to the top of the plate, from whence it is drawn off by the tube A, shown above the top of the plate. The ammoniacal liquor at the same time is drawn off by the fixed tube B shown below the plate. No suction-pumps are required; the tar and the liquor forcing themselves through the tubes by reason of the great peripheral velocity. The screws shown on the drawing (and as you can also see on the small model I have before me) are for regulating the distance of the tar-tube from the wall of the drum. When the drum has to be quite emptied before stopping, this tube is screwed outwards till it nearly touches the walls; and it thus empties the drum down to the last drop.

Very little mechanical skill is required, and an ordinary labourer will learn to work the machine perfectly in four days. Its construction is simple and strong, and not at all liable to get out of repair. The experience in Copenhagen has been that, in four years, less than 1 per cent. (during the four years) has been spent in repairs. The mouths of the tubes wear out slowly; but, as they are made to screw on and off, there is no difficulty and no waste of time incurred in changing the points.

The "spun" tar is not only free from water, but also in a way purified. All grit, dirt particles, and the heavy pitch adhere to the walls of the drum; and the machine is therefore stopped three times a day to be cleaned out. This is effected quickly by means of specially shaped scrapers, which clear the whole drum in less than half an hour. The pitch and refuse so obtained are placed on one side, until sufficient is collected, and then either mixed with small coke and burnt under the gas-works boilers or else it is mixed with ashes and sold to make cheap paths.

By extracting the water, the tar is naturally made much more valuable for the distiller, for much time and expense are saved him in getting his tar down from about 8 to 3½ per cent. of water, but also the difference between the 3½ and the 1 per cent. (which is the result obtained by this method). Although this difference does not sound much, it means a great deal and a large saving to him in time and coal during the operation of distilling. You must also bear in mind that this machine does the whole operation—from 16 per cent. or more water down to 1 per cent. in one treatment. The tar is ready for the market at once. With the old-fashioned method, it is on hand a long time, and has to be agitated and treated several times. This small machine does in a few minutes what is not so thoroughly accomplished by the old method in months.

Again, with the tar free from water, there are none of the sudden upheavals that sometimes occur when a small pocket of water is suddenly converted into stream in the still, and forces its way through the mass of tar, and sometimes causes it to start "boiling over." This danger is entirely got rid of by using only "spun" tar in the stills.

In addition to this, there is the other point I must consider, now that so many of us are using or contemplate using tar for carbonizing and burning purposes. With the tar absolutely free from water, the effects when carbonizing it are much more satisfactory; and the fullest calorific effects are obtained from the combustion. In this way therefore the process would prove in my opinion a saving. In the case of oil gas tar, which is now sometimes burnt with as much as 19 per cent. of water in it, it most certainly would show a great saving.

I mentioned a few minutes ago that the tar required warming during cold weather before passing into the machine. The apparatus for this purpose is very rough and very cheap—consisting of a tank 6 feet long, by 6 feet high by 3 feet wide, containing an iron coil, through which exhaust or other available steam passes. The coil need only be built up roughly of iron tube, as it does not matter in the least if water condenses and leaks into the tar, as the machine promptly takes it out again.

These processes, as you are all aware, are sometimes very pretty theoretically, but practically do not serve their purpose, as they cost more than they save. This, however, is not the case I think you will find in this instance. I have before me a balance-sheet comparing the cost of a day's working (in connection with the tar) of the old system of gravitation and the new system of mechanical separation. The figures do not include any estimations, but are from actual working experience at the East Gas-Works of Copenhagen; and the balance-sheet proves very conclusively that this system is commercially, as well as mechanically, a great improvement on the old. I notice in the first place that the power required is very small—viz., four brake horse power; and according to the Copenhagen practice, the sulphate of ammonia obtained from the liquor saved more than pays for the cost of operating the machine, including high charges for interest, depreciation, and repairs. The figures given for labour would not, of course, apply for England, as their labour is cheaper than ours. But this does not affect the final result, as the labour is the same for the old and the new style.

The Copenhagen practice is the same, practically, as the average English; and this would naturally be the case, as they employ the same plant, the same methods, and they also import Newcastle coal for making their gas. They usually get about

10½ gallons of tar per ton of coal carbonized; and the sulphate of ammonia works out at about 22½ lbs. per 30 gallons of liquor (or 22½ lbs. of sulphate per ton of coal carbonized). The prices they obtain are, of course, slightly different; but the proportion (when comparing with expenses) is again about the same. They obtain, on an average, 11 ore per lb. sulphate (8 ore = 1d.); and their expenses for extracting the sulphate from the liquor are 6 ore exactly—¾d. per lb. The figures given in the balance-sheet clearly show that, if they only obtained their profit from the extra sulphate saved, and they sold their "spun" tar at the same price as green tar, they would only save about 3s. per day, including all charges for working, interest, &c. As, however, they obtain a higher price for their "spun" tar (the exact figure is 16½ per cent. higher), they find that, on such a small amount as 2800 gallons of green tar, they save £1 5s. 10d., which you will agree with me is a very satisfactory result. Not only do the gas companies profit by it, but the distillers also save by using the "spun" tar. They cheerfully pay 16 per cent. more for it; for they find that, even so, they save 12 per cent. when comparing it with the old quality of green tar. I have no data to substantiate this last figure; but I am informed that this is a fact.

Since the foreign gas-works have adopted this method, they have never found any difficulty in disposing of their tar. We all have experienced at various times some difficulty in disposing of our tar at a remunerative figure; and so in former times did these foreign gas-works. Now, however, the "spun" tar seems to sell itself; and they readily obtain the higher price. In the summer, they are not able to keep pace with the demand.

Well, gentlemen, I think I have told you sufficient to make you think this new system is well worth consideration and looking into. If, where the other conditions are so very similar as here and in Copenhagen, this process can show a saving—which, on the old principle of "a penny saved is a penny earned," I may safely call *money earned*—of £1 5s. 10d. per 2800 gallons, I think I may say that you will all agree with me that we can at times learn something from our colleagues in foreign countries.

Manchester District Institution of Gas Engineers.—We learn from the Honorary Secretary of this Institution (Mr. S. S. Mellor, of Northwich) that the Committee have arranged for the 98th quarterly meeting to be held next Saturday, when an excursion will be made from Manchester to Liverpool *viâ* the Ship Canal, for which purpose the *Manx Fairy* has been specially chartered. On this occasion, ladies may join the party. The steamer will leave Trafford Wharf at eleven o'clock; and luncheon will be served on board. The only business will be the confirmation of the minutes of the previous meeting, and the election of two new members—Mr. C. A. Craven, of Dewsbury, and Mr. W. R. Herring, of Huddersfield. These matters will be disposed of in the afternoon. Liverpool will be reached about four o'clock; and tea will be provided at the "Bear's Paw," in Lord Street.

Natural Gas and Petroleum.—This was the title of a paper read a short time since, by Mr. H. M. Cadell, before the Edinburgh Geological Society. Starting with the general question of the origin of the natural forms of hydrocarbon which was found most abundantly in America and the Caspian region, the author said they occurred in all geological formations, from the lower Silurian to the Tertiary, but chiefly in the lower part of the Carboniferous, the Devonian, and Silurian in America, and the Eocene in the Old World. The American oil and gas was found chiefly in two kinds of rock—sandstone and limestone—both of which when petroliferous were more or less porous, and capable of acting as reservoirs to contain the hydrocarbon produced by the decomposition of plant and animal remains. After dealing with several theories explaining the origin of natural gas and oil, Mr. Cadell stated that the so-called anticlinal theory of their distribution explained most of the phenomena observed in the American oil districts. The gas wells were found generally along the crests of the anticlinal arches, the oil lower down on either side, and brine under the oil syclinal hollows in the oil strata—each fluid occupying a place determined by its relative weight. There were comparatively few American States in which some oil had not been discovered. Since 1859, when the oil was first struck, the whole production up to the end of 1891 had reached the grand total of about 22,000 million gallons. The Caspian wells were neither so deep nor nearly so numerous as in America; but the yield of individual wells was often much greater. The Baku oil appeared to occur in huge cavities isolated from one another, and not in regular strata such as were common in America. Many spouting wells had been plugged up; and although the supplies were exhaustible both here and in the States, there was every reason to suppose that the supply which had lasted for 2500 years would last for a long time yet. Looking to the numerous geological formations containing oil, its wide geographical distribution, and the improved facilities for its transport, Mr. Cadell thought there was very little probability of an increase in price, in the near future at all events. A penny a gallon laid on all imported mineral oil would, he said, produce to the Government a substantial revenue, and at the same time would prevent the total annihilation of a very important home industry.

OHIO (U.S.A.) GASLIGHT ASSOCIATION.

(*Continued from p.* 842.)

A paper on "Coal Tar Pitch: Its Uses and Future Market," was read by Mr. Watt, of Chicago, who remarked that this product was first introduced into the United States as a residue from the distillation of tar, imported from abroad. But the demand thus created led to special attention being devoted to the quality of the pitch; and the American distillers, unlike their European competitors, regarded the pitch as the primary, and the chemicals as the secondary product, with the result that the home product now ranked first in the market. Proceeding to refer to the uses of pitch, the author claimed that a pitch and felt roof was cheaper, more durable, and safer than iron roofs. While the iron came apart in case of fire, and let out the flames, pitch roofs fell in bodily, and tended to smother the conflagration. Pitch was greatly in demand as a filling both for brick and stone pavements; and without such filling the pavements were like a leaky roof in wet weather. It was also largely used for the manufacture of artificial asphalte. Some 6½ million yards of this substance had been laid in Washington (D.C.). In Pittsburgh, fully 80 per cent. of the asphalte pavements were laid with coal-tar pitch. It was also used for electric lighting carbons, for coating wood pipes, for lining acid-tanks in chemical works, for coating gas and water pipes, for ships' bottoms, and for making briquette fuel. With the introduction of water gas, the production of coal tar had decreased; and while the pitch from petroleum products was not so good, its cheapness had led to its being adapted with fair success to many of the uses of coal-tar pitch. Still the makers of pitch had reason to look for an improving and profitable market.

On discussion being invited, Mr. Holmes asked how it was that, so far as he knew, only one gas company had entered into this business, and he was told that they failed. Mr. Somerville said he attributed the cause of the failure to want of capital. But he had hoped to hear something in the paper about the possibility of getting gas from tar. At Peebles, in Scotland, he understood that 14,000 cubic feet of 22-candle gas and 13 cwt. of superior coke were obtained from a ton of tar. So he thought the proper direction in which to look was towards the production at the gas-works, not of tar, but of pitch, by retaining all the lighter constituents as gas. If he were designing a new retort-house, he would arrange to run the tar into a still, and return the oily matters into the hydraulic main. The water in tar from water gas could be easily extracted; and he had heard on good authority that this material was as useful as coal tar. Mr. Miller said that the water could be entirely extracted from water-gas tar by passing it through a separator, maintained at a temperature of 150° to 160° Fahr. He instanced a works, making about 170 million cubic feet of gas per annum, where this was effectively done with a small separator, about 6 feet in diameter and 6 feet deep. Mr. Welch ascribed the present low price of tar to the fact that the producers were entirely in the power of the purchasers. There was no reason whatever why tar should not realize the prices of 1890 and 1891, instead of about one-half; and gas companies must help themselves, by doing anything and everything they could to keep it off the market. Let them enlarge their storeage, find local uses, or burn it, rather than throw it on the market at any price. The President thought that gas companies did not incur any risk by converting their tar into pitch.

Mr. Watt replied to the various questions. He said he understood that water-gas tar contained 35 or 40 per cent. of water, and that many experiments had been made at Chicago with the view of separating it, but without success. At the present price of pitch, tar was worth 2d. per gallon or more at the still. The waste was from 25 to 40 per cent., according to the quality of pitch made; and the cost of distillation might be put at 6s. per ton. Electric carbon makers wanted a hard pitch; and they imported pitch in considerable quantities from Britain. Sometimes 3000 barrels a week were brought into the country; but, although it was cheap, it was not so good. The production of tar in the United States was not equal to the demand. Last year the prevailing price for pitch was above £3 per ton; but this year it was somewhat lower. Foreign pitch was quoted as low as £2 10s.; but it caused dissatisfaction, because the bulk was not always up to sample. The other products besides the pitch were light oil and dead oil. The latter was not worth so much as tar. It was a good fuel, and largely employed for making lampblack. The tar used for making tar felt should net 3½d. per gallon to the seller.

The Secretary at this stage read a communication from Mr. A. C. Humphreys, on the subject of the "Municipal Control of Gas-Works." Seeing a statement in a Philadelphia newspaper to the effect that this system had been largely and successfully introduced in Germany, Mr. Humphreys had enclosed it to Herr W. von Oechelhaeuser, the General Director of the German Continental Gas Company, and had received a full reply, which went to show that, in almost every way, the consumer was better off when served by a company than when supplied by a municipality, and that municipal control of gas-works was not so extensive or so successful in Germany as the Philadelphia writer supposed. Mr. Humphreys regarded the letter as a complete refutation of the statements; and he

proceeded to show that, notwithstanding the fact that politics did not enter so much into municipal affairs in Germany or in Great Britain as in the States, in neither country was municipal management more successful than private enterprise. Private concerns, working for their own gain, practised economies and adopted improvements more readily than municipalities, who had no similar incentive. But in the United States there was the further objection that municipal control was inseparably joined to machine politics and the "boss" system; and additional control simply meant additional corruption.

Mr. W. C. Boyle, of Salem, read a paper entitled "Gas Companies and the Public," in the course of which he referred to the benefits secured to mankind at large by joint-stock enterprise; and yet there was, he said, a marked desire on the part of the public to limit the privileges and increase the burdens of established undertakings. This was so deep seated that a company seldom had their rights considered, or were treated with justice, by a jury. A large share of this was simply prejudice. There was no reason, and consequently no remedy, for it. The aim of every gas company should be not only to earn reasonable profit, but to retain the good-will of the public. The previous history of gas undertakings in the States showed that this public feeling was not entirely ungrounded. At first the tendency was to treat gas companies too liberally; but now there was a decided reaction in the other direction. But he contended that gas companies had recognized the errors of their early abuses, and were anxious to serve the public upon fair business principles. In this they were handicapped by having their good intentions misconstrued. They did not suffer so much from the power reposed in municipal bodies, as from the character of the men who exercised it. No doubt there were already many good honest men on the village and city councils. But there was room for more of them; and he advised the giving of personal time and attention to the placing of good citizens in the municipal offices. It had been said that gas companies gained most by bribery; but this he emphatically denied. The honest man was their best friend. It would be well to carry the point farther, and, in pressing for honest treatment, to see that they in their turn were dealing fairly with the public. They should carry out their contracts faithfully, and attend carefully to all complaints—seeking to give their customers the best possible value for their money. This was the direction in which they should work to counteract the evils of prejudice.

Discussion having been invited, Mr. Cantine heartily supported the conclusions of the author, but said he could not agree that gas companies had at any time oppressed the public. Their conduct would compare favourably with general business practice. On the other hand, some of the dealings of the public—such, for example, as the proposed franchise tax in Ohio—were decidedly unjust. Mr. Somerville pointed out that every consumer had a stopcock on his meter; so that it was his own fault if he had more pressure than he required. Mr. Allen thought gas companies were not so unpopular as some people seemed to believe. No fairly prosperous undertaking would escape a certain kind of opposition; and he agreed that some of this was due to errors in the past. He thought it would be a mistake to let it go forth as an admitted thing that gas companies were not popular. Mr. Faben submitted that much of the dissatisfaction spoken of was due to local causes; and the remedy would be different in each case. Mr. Miller said it was possible to control and influence public opinion. Mr. Gwynn wished to remark, in reference to what Mr. Somerville had said, that the meter stopcock was not a suitable appliance for regulating pressure. Mr. Kauke was in favour of proper representation of the gas interests in the municipal council. The President agreed that gas companies were not so unpopular as had been assumed; but they would do well to study how to render their business popular.

(To be continued.)

Institution of Mechanical Engineers.—The members of this Institution have received permission to visit the gas-works of Manchester and Salford during their annual meeting in Manchester at the end of July and the beginning of August.

The Distribution of Water Supplies.—At a recent meeting of the Liverpool Engineering Society, Mr. T. Duncanson, Assoc.M.Inst.C.E., read a paper on the above subject. He first gave data as to the quantity of water required to be provided for the use of a district, and the variations in the rates at which it must be supplied; showing that the maximum rate at any hour during the year exceeds the average by about 85 per cent. He then spoke of iron distributing and service mains, the rules for determining their sizes and their rates of deterioration, and the various classes of house service-pipes and how to protect them from frost. Some experiments on service-pipes were described, which showed that lead pipes likely to be exposed to the effects of frost should be made of greater strength than is necessary if only the hydraulic pressure to which they are subject is considered. House sanitary arrrangements were discussed from a water-works point of view; and the author showed that, if properly utilized, the allowance of 2 gallons per flush for closets was sufficient. The paper concluded with a few remarks on the systems adopted for the prevention of waste, and the general principles on which a water supply should be distributed.

REGISTER OF PATENTS.

Mantles or Hoods of Incandescent Gas-Burners.—Bohm, L. K., of New York, and Crawford, T. C., of New Brighton, U.S.A. No. 4732; March 6, 1893.

This invention of "mantles, hoods, or like devices used in connection with gas, and rendered incandescent by the combustion of the gas to increase the illuminating effect," relates particularly to a composition to be used in the manufacture of the incandescent devices containing magnesium oxide as the base. This material, when heated, emits the light; but used alone, it lacks cohesion. There must therefore be combined with it other substances, for the purpose of making the mantles durable in use and reasonably strong for transportation. This substance forms a supporting skeleton of non-incandescent material; and, obviously, say the patentees, "in order not to impair materially the incandescence, these substances should constitute as small a percentage of the mass as possible, and at the same time secure reasonable strength and durability."

The claims for the invention, therefore, are: (1) A composition of matter for incandescent hoods, consisting of magnesium oxide, silicic acid, and an alkali. (2) A composition of matter for incandescent hoods, consisting of magnesium oxide, silicic acid, alkali, and phosphate of lime of magnesium. (3) The process for making a composition for incandescent hoods, consisting in first mixing gelatinous silicic acid, as it is formed by precipitation, with a sugar solution, and rubbing well together; and then adding successive quantities of magnesium oxide, and rubbing together until the mass is uniform. (4) In a process for forming a composition for incandescent hoods, composed of magnesium oxide, silicic acid, and an organic binder, the use of silicic acid in a gelatinous condition as formed by precipitation.

Prepayment Mechanism applicable to Gas-Meters.—Simpson, S., of Mansfield. No. 7991; April 20, 1893.

This invention relates to prepayment mechanism applicable to gas, electricity, and like meters, in which a predetermined quantity is supplied in exchange for coin, or in which the supply is continued for a predetermined time, in exchange for such coin. The chief feature of the meter is the provision of differential wheels, for controlling the supply, used in combination with a pair of spring-connected pinions, which serve to gradually restore the differential wheels to their initial relative position as the mechanism rotates after one of the wheels has been turned with respect to the other through an angle depending on the number of coins passed through the apparatus. Another important feature relates to the means employed for adjusting one of the wheels with respect to the other, as the coins are passed through.

Fig 1

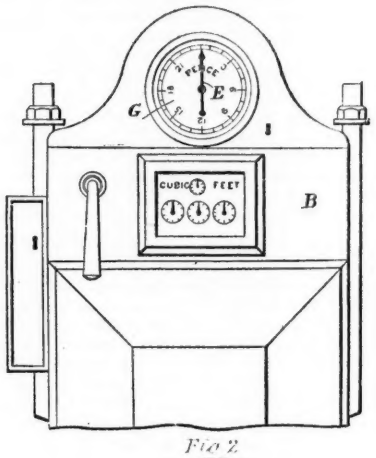


Fig 2

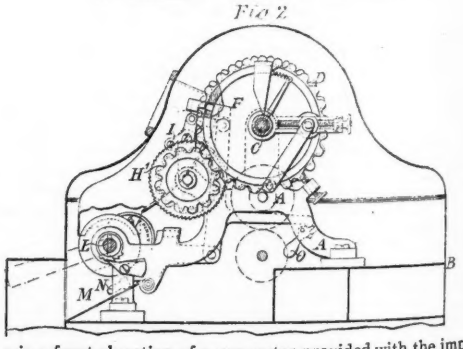


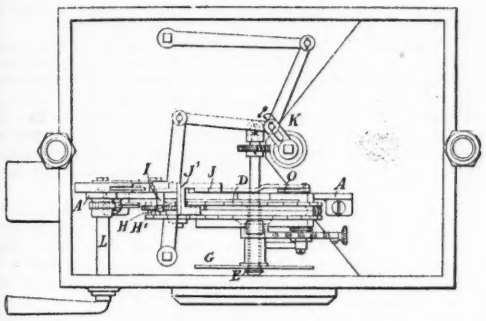
Fig. 1 is a front elevation of a gas-meter provided with the improved mechanism for regulating the supply of gas. Fig. 2 is a section through the upper part of the casing (to a larger scale), representing one form of the mechanism in front elevation, a part being shown in section, and the dial being removed. Fig. 3 is a plan of the parts illustrated in fig. 2, and showing also the connection with the ordinary mechanism of the meter.

A is a frame, constructed to be attached to the case B of the meter, and formed to carry the coin-controlled mechanism. To the upper part of this frame is fixed a stud C, on which revolves loosely a toothed wheel D, having (say) 24 teeth, and with a boss extending to the end of the stud, carrying a pointer or finger E. Carried loosely on the boss of the wheel, between it and the finger, is a wheel F having (say) 25 teeth, or one more than D. The adjoining faces of these wheels

are furnished with projecting rims or flanges respectively, of the same diameter, and bearing against each other, and having each a slot or groove respectively cut in the periphery, for a purpose to be hereafter described. A spring bears on the rim of the wheel D, controlled by an adjusting screw, so as to steady the wheel, which, as above stated, is loose on its spindle.

The wheel F carries on the end of its boss a dial G, divided into the same number of parts as there are teeth in D; and it is geared with the ordinary mechanism of the meter (either directly or indirectly), by means of an additional toothed wheel formed with, or connected to, it. The gear is so proportioned that the wheel F makes one revolution in the predetermined time, during which the apparatus shall be in action, or while the prearranged quantity of gas is being delivered in exchange for the arranged coin. Or the wheel F is driven by a silent feed-clutch, as in fig. 2. Gearing into the toothed wheels D F are two smaller toothed pinions H H^1, having the same number of teeth as each other, and revolving loosely on a fixed stud attached to the frame. The pinion H^1 is made of greater width than the wheel into which it gears; and in this extra width there engages a spring pawl, or equivalent device, attached to the other pinion H. This spring ordinarily locks the two pinions together, but allows the pinion H to be turned one or more teeth with respect to the pinion H^1 when required; the second pinion being meanwhile held stationary by the propelling mechanism of the wheel F—that is to say, by the ordinary meter mechanism. It is possible to move the pinion H by means of a pawl I, pivoted to a short lever, which preferably swivels on the stud that carries the two pinions H H^1. The pawl is so shaped as to be able to engage with the teeth of the pinion H, or (preferably) with the teeth of a ratchet-wheel, fixed to the pinion H. It is provided with an arm, which is connected by means of a link or its equivalent to the upper part of a longer or second lever J, pivoted to a part of the frame. The upper part of the lever is formed with a hook-shaped projecting finger J, which bends round the teeth of the wheel D, and bears on the peripheries of the flanges of the wheels D F. The lever is normally held in this position by a spring; and, when so held, the pawl I is kept clear of the ratchet-wheel.

Fig 3



A hooked arm is provided on the lever J in such a position as to be adapted to engage with any convenient part of the mechanism of the meter, so as to stop the supply when the quantity paid for is consumed. For example, the hooked arm is adapted, in one position, to engage with and lock the crank K (fig. 3) of the ordinary meter mechanism. The lever is extended below the pivot; and a sliding piece is pivoted thereto, so as to work in a guide formed on the frame A and rest on a roller carried by the frame.

L is a spindle capable of rotating in a bearing in the frame, and extending outside the casing, being furnished with a handle for turning it. On the inner end of this spindle is fixed a coin-holder, with a slotted part which allows of coins smaller than those of the proper size to pass through, and with curved parts to receive and form a bearing for coins of the right size. The handle can be turned in one direction only; its spindle being furnished with a strong ratchet-wheel, with which engage preferably double pawls pivoted to the frame. These pawls are arranged one slightly in advance of the other; and they operate alternately, in the well-known manner, to prevent rotation of the handle in the backward direction. When a coin of the right size is dropped into the holder, and the handle is rotated, the edge of the coin is brought into contact with the above-mentioned sliding-piece, and is caused to force it backward; thus turning the lever J about its pivot. By this means, the pawl I is first put into engagement with the teeth of the ratchet-wheel, and then caused to turn the wheel, and so move the pinion H one or more teeth forward, as desired, in which position it is held by the spring pawl engaging in the second pinion.

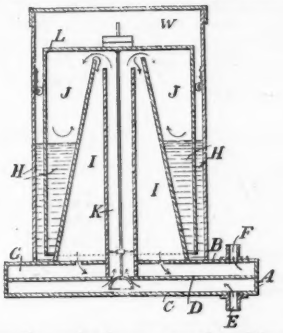
The coin is passed through a slit in the outer case of the mechanism, and is guided to the rotating coin-holder by means of a suitable shoot. After operating the mechanism, the coin is passed through a delivery-shoot M, and into a money-box provided for the purpose. The coin-holder is slotted, so that any smaller coin than that required to be tendered falls through and into the money-box, without coming into contact with the operating mechanism; and the patentee prefers that the coin of proper dimensions, after working the mechanism, shall be made to pass between springs N in the delivery-shoot, which nip the coin and operate to draw it out of the holder, and thus prevent it from sticking or becoming fixed by grease, or like substance. The coin is only held by the springs during a part of the revolution of the handle; and it is forced from between them by the coin-holder, as the latter completes its rotation. The ratchet-wheel and pawls fixed to the frame engaging therewith prevent the operation known as "pumping," or working the coin backwards and forwards, by which an excessive supply of gas might be obtained by the coin. A further safeguard against fraudulent use of the meter is provided by a stop O, pivoted to the frame, weighted and adapted when released to engage and lock the crank K. This stop is normally held clear of the crank, by means of a pin fixed in the hooked arm of the lever J, which pin presses on the edge of the stop. Immediately the coin-holder is rotated with the coin held therein—thus moving the prepayment mechanism, and raising the arm—the stop O is liberated; and a part of it comes into the path of the crank K, and arrests it; thus stopping the supply of gas until the coin is so far rotated as to clear the mechanism and fall into the money-box. Thereupon the lever J is drawn back by its spring, and the arm is depressed again, and the pivoted stop thereby removed from the path of the crank, so as to allow the latter to turn.

The action of the meter is as follows: When it is stopped, and no coin has been tendered, the finger E stands at zero, and the grooves or slots in the two rims or flanges on the toothed wheels D F are opposite that part J^1 of the lever J which rests on the rims or flanges. Consequently, the part of the lever has been forced into the slots or grooves by means of the spring; thus depressing the hooked arm into the path of the crank K, and arresting the supply of gas. On a suitable coin being inserted and passed through the apparatus by rotating the coin-holder, the lever J is turned; and the part J^1 is drawn out of the slots or grooves in the wheels, thus unlocking them, and at the same time the pawl I is advanced and caused to turn the ratchet-wheel, thereby turning the wheel D one or more teeth in the opposite direction to that in which the wheel is rotated by the motion communicated by the meter mechanism. The slots are thus separated a distance equal to one tooth; and the part J^1 of the lever J, which extends across the whole space between the wheels D F, cannot fall into the slots until they are brought together again, but rests on the rims. Simultaneously with these movements, the arm of the lever J is raised and releases the crank K, thus allowing the meter mechanism to rotate, and a supply of gas to be obtained. But the pivoted stop O operates to lock the crank K until the coin has been delivered into the money-box, and the arm has so far descended that the part J^1 of the arm J rests on the flanges of the wheels D F. When the wheel F, which has the larger number of teeth (and which wheel is in gear with the mechanism of the meter), has been carried completely round as the gas is consumed, the slots or grooves in the wheels are brought opposite to each other again, and the part J^1 of the lever J falls into the slots or groove already mentioned, thus arresting the supply once more. The pointer E is at the same time brought back to zero on the dial.

Any number of coins may be inserted successively at one time, provided the pointer is not thereby carried round one complete revolution of the dial; and it will be seen that, before the slots are brought together again, the wheel F must make as many turns as the number of coins inserted.

Gas Pressure-Regulators.—Brookes, A. G.; communicated from D. Wilson, of Boston, U.S.A. No. 9787; May 16, 1893.

This invention relates to regulators which are placed intermediate between the supply-main and the distributing-pipes. It has for its object "the provision of such a device as will automatically control the supply of gas, and which will allow it to expand, so that it will enter the distributing-pipes at a comparatively low pressure, whereby a more perfect combustion will be secured, and a consequent saving."



The illustration shows the valve in an opened position. It consists of a base portion, with a cylindrical wall A, of but comparatively little height, and of top and bottom plates B C. It is divided by the horizontal partition D into two expansion chambers, the lower of which connects with the inlet-pipe E, and the upper G with the outlet-pipe F. The casing consists of the cylindrical wall, of much greater height and of a somewhat shorter diameter than that of the base, and placed eccentrically on the latter, away from the inlet and outlet pipes, so as to give more room to the pipes than if the relative positions were concentric. A partition divides the casing into the fluid chamber H and the expansion chamber I; the former being closed between the partition and the wall of the casing, and the latter chamber by the partition itself. In the fluid chamber, glycerine is placed. The space J above the glycerine is also an expansion chamber; and the expansion chambers thus formed connect with each other, and are connected with the inlet-chamber of the base by the pipe K. The chamber I connects with the outlet-chamber through an opening in the plate B.

Within the fluid chamber is placed a float L. It consists of a cylindrical wall, having a diameter less than the wall of the casing, and of a top plate. The float encloses the two upper expansion chambers; and it automatically operates to open or close the valve which controls the opening leading from the inlet-chamber of the base and the pipe K. Proper adjustment of the float is secured by weights W.

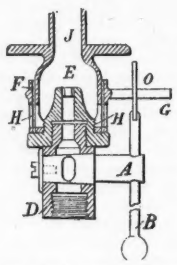
The operation of the device is as follows: Assuming the float in its normal position—that is, depressed so that the valve governing the opening leading from the lower chamber will be open—the gas passes through the pipe K into the expansion chambers I J. In these latter chambers the gas collects; and when the pressure becomes great enough, by pressing upon the glycerine, and thereby increasing the buoyancy of the float, the latter will rise and close the valve, and consequently the flow of gas. The quickness with which the float acts depends upon the extent to which it has been weighted. The gas which has passed into I J will expand therein, and flow into the upper chamber G, from which it passes to the pipe supplying the burners.

Regulating Incandescent Gas-Lamps.—Beaux, P. W. de, of Leipzig, Saxony. No. 10,454; May 27, 1893.

This device, as shown in the engraving, allows "any person (though unskilled in such lamps), by merely moving one lever, to either cause the flame to burn at full strength, or to restrict its power to any desired degree without any danger, and even so far as to be scarcely visible without extinguishing it entirely." The illustration represents the burner of an incandescent gas-lamp having its cock entirely open, so that a light of full power is produced.

Fig. 1

Fig 2



The cock A has on its face, opposed to the bore of the casing D, two semi-circular notches, lying opposite each other, which, according to the positions of the lever B, allow of a larger or smaller amount of gas to pass through. The notches have this important advantage, that the diameter of the passage-way offered to the gas can be far more exactly regulated by the lever than would be the case if an ordinary cock with a medium-sized passage-way were employed. To provide that the flame will not be extinguished on placing the lever full over to the left, the cock is provided with a small passage-way bored through it, which allows a slight amount of gas to pass continually. In the casing J, in connection with the gas-cock, and surrounding the nozzle E, holes are made, and similar holes are provided in the surrounding sleeve F. If the latter is turned, the inner air-holes will be closed or opened thereby. The lever B carries in its upper prolongation a hole C, in which the pin G of the sleeve engages. The hole is of such form that the pin in any position of the lever closely touches both edges of the hole; and thus it always occupies the desired position. By this arrangement, the amount of air admitted through the sleeve F is always suitably proportioned to the amount of gas passing through the nozzle E; the correctness of this proportion being necessary for producing the desired flame. In this manner a satisfactory burning of the gas, it is claimed, is obtained without any danger to the mantle.

APPLICATIONS FOR LETTERS PATENT.

8530.—Furness, E., "Rotary engines, pumps, blowers, and exhausters, and fluid-meters." April 30.
8579.—Webb, W. Le P., "Oil and gas motor engines." May 1.
8588.—Glasgow, A. G., "Water-gas apparatus." May 1.
8668.—Hogg, T. C., and Grove, J., "Oil or gas engines." May 2.
8764.—Proctor, J., "Mechanical stokers." May 3.
8926.—Kilpatrick, J., "Joints of pipes." May 5.
8946.—Harrison, T. B., and Hudson, G. W. S., "Carburetting gas-lamp." May 5.
8974.—M'Ewen, T. G., "Manufacture of gas." May 5.
8980.—Fraser, K., jun., "Meters." May 5.
8981.—Sutherland, A. G., "Prepayment gas-meters." May 7.
9033.—Hausenblas, J., "Heating vehicles with gas." May 7.
9049.—Uehling, E. A., and Steinbart, A., "Analysing gases and gaseous mixtures." May 7.
9063.—Rice, G., and Wooding, J., "Gas, oil, and spirit stoves." May 8.
9071.—Berry, J., "Detection of waste water as supplied under pressure." May 8.
9189.—Jones, J., Farrer, F. T., and Brown, W. W., "Water-waste preventers or flushing apparatus." May 9.
9197.—Hawkins, H. and S. H., "Production of hydrocarbon gas and metal sulphates as bye-products." May 9.
9209.—Graf, F., "Bunsen gas-burners." May 9.
9297.—Willatt, J., "Apparatus applicable to gas-burners." May 10.
9305.—Dickinson, W., "Gas or vapour engines." May 11.
9323.—Peacock, N. B. J., and Dinsdale, H. M., "Gas and other explosive engines." May 11.
9395.—Pye, T. E., and Scull, C. E., "Valves or regulators for gas and chemical works." May 12.
9457.—Bueb, J., "Drying lighting gas." May 12.

The Gas Profits of the Burslem Corporation Gas Department.—According to a statement made by Mr. T. Hulme at the recent quarterly meeting of the Burslem Town Council, the Gas Department experienced a considerable decrease in the consumption during the past year; manufacturers having required less than in previous years. The total income from gas (discounting bad debts, &c.) had been £15,413—a reduction of £1011 on the preceding year. The income from other sources showed an increase of £135. The total ordinary expenditure was £15,919—an increase of £237. The profits, apart from special expenses, came to £3874, as against £4987. Of this £2500 was given in aid of the rates, and £1374 in reduction of the cost of the gasholder. Mr. Hulme added that the coal strike had caused an extra expenditure of £500.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The "Lancet" Commission Report on Gas-Fires.

Sir,—We are glad to note, in the last number of the Journal, Mr. Folkard's criticisms on the report of the *Lancet* Commission, as they may tend to hasten a very desirable proceeding—viz., the extension of the inquiry so as to include a broad variety of systems experimented upon, and a simplified report that would constitute a guide for the public, and not be merely "technical," as in the former case, the tabulated results in which were doubtless interesting to manufacturers and experts, though we greatly question if they were more than glanced at by the public. In February last, we sent to the *Lancet* a few criticisms of the report; and, whether they were sound or not, in view of Mr. Folkard's re-opening the matter, we place them at your disposal, as possibly representing views held by others of your readers.

We pointed out that the "inquiry" was very restricted in its scope, as, with the exception of one stove, it was limited to only one system of burning gas—*i.e.*, the atmospheric burner—and entirely ignored more recent developments; also, that the report was deficient in the following respects:—

(1) It omitted to give any information as to the number and disposition of the thermometers, also to state whether the thermometer in column 5 was included when arriving at the results in column 4. Without this we were unable to form any comparison with results obtained by our own system.

(2) It neglected to state whether or not stove P was connected to a flue—apparently, however, the latter, in view of the high heating mean compared with the consumption and the amount of carbonic acid present.

(3) It contains the conclusions of the Commission as to the best "principle" of heating; but it omits any opinion as to the most efficient, economical, and hygienic "method" of warming a room—viz., the desirable location of the heat when obtained, whether at the walls, floor, or ceiling.

(4) It does not express any opinion, from a hygienic aspect, as to the use of gas-stoves (Bunsen or luminous flames) without a flue attachment, but with efficient ceiling ventilation provided.

(5) With regard to the "mean heating" power of the respective stoves tested, in order to obtain comparisons of efficiency, an additional column is required in the tables, showing the mean heating effect per hour per cubic foot of gas. This column should be included in both series, "Maximum" and "Minimum;" and by its aid comparisons would be apparent at a glance. It is somewhat curious that while in some of the stoves the percentage of efficiency is identical with both pressures, in others the percentage decreased or increased according to the pressure.

The report, moreover, bore evidence of insufficient information as to appliances, and was also, in our opinion, somewhat contradictory and inaccurate. For example, on page 1 it states that "great improvements have been effected in the construction of gas fires and cookers." This is true as far as mechanical details are meant; but there is practically no change or improvement in principle. On pages 3 and 4, the descriptions of stoves D and P are apparently recommendations; whereas both contain the principle of "warm air," which is condemned later on (page 9). Moreover, the description of stove P as applicable in cases where no flue is possible should, considering the excess of carbonic acid as per table, have been qualified by a proviso as to efficient ceiling ventilation. On page 8 it is explained that Bunsen burners were selected because they "give greater heat" than that from luminous flames, and, moreover, can be "used for heating fuel," whereas, "luminous flames deposit carbon" when employed in this way. We contest both statements, and contend that, the degree of combustion being equal, the heat-units per cubic foot are precisely the same with both types. Luminous flames, impinging upon fuel, can be successfully employed with entire absence of carbon deposit. On page 10 (*re* cooking) it is stated, as being universally the case with luminous and Bunsen burners, that "in both cases the joint is exposed to the products of combustion." We deny this.

In view of the importance of this subject and of the fact that thousands of the *Lancet* reprints have been distributed to the public (in addition to the circulation of the paper itself among the medical profession), it is to be hoped that the inquiry will be continued at an early date, and, pending this, that suggestions and information will be forthcoming that may assist the Commission in compiling a thoroughly complete and reliable report, and one that will be useful alike to manufacturers, gas companies, and the public. We would suggest that, in the revised report, each appliance should be clearly described by the name of its maker or patentee, as well as by its catalogue name, number, or class. It can then be easily identified, and will stand or fall by its merits. We fail to see any useful object in omitting the information.

Hersey Bros., Limited.

May 17, 1894.

The Yeadon Revolving Retort.

Sir,—As stated at the meeting of the North of England Gas Managers' Association in Newcastle last Saturday, I shall ere long publish some data we have obtained from independent actual working and on a more extended scale than it has hitherto been possible for us to do—data, I may add, that will be convincing to all who are free to study it without prejudice.

D. M. Nelson.

Glasgow, May 12, 1894.

The Use of Gas-Engines in Gas-Works.

Sir,—After a lapse of nearly a year, Mr. Lees has reverted to a paper of mine read before The Gas Institute at Belfast, and has endeavoured to show that I understated the number of gas-engines used in gas-works.

What I said was: "I believe there are about 1600 gas-works in the United Kingdom; but gas-engines are used at only 200 of them. In

most cases, these engines are of 4-horse power nominal and under—several being of ½-horse power, and some less. There are only seven of 12-horse power; but five of 16-horse power, and none of larger size." I may be wrong as to the number of gas-works in the United Kingdom; but as to the 200 engines in use a year ago, I beg to say that, before writing my paper, I wrote to all the leading makers of gas-engines, and they were good enough to give me particulars of all engines sold for gas-works. The figure 200 is based on this information; and if Mr. Lees will inquire more closely than he appears to have done, I think he will find that his opinion, not mine, "has been formed on insufficient evidence."

J. EMERSON DOWSON.

39, *Old Queen Street, S.W.*,
May 18, 1894.

The Cost of Manufacturing Sulphate of Ammonia.

SIR,—In response to the invitation contained in the article on the above subject in the last number of the JOURNAL, I send for publication the accompanying figures as the experience of a small provincial maker of sulphate of ammonia for a number of years.

SULPHATE.

May 19, 1894.

[ENCLOSURE.]

Cost of Manufacture per Ton of Sulphate.

	£	s.	d.
Vitriol	2	0	0
Rent and taxes	0	5	0
Interest on outlay	0	4	0
Depreciation	0	2	6
Repairs	0	7	6
Water	0	1	6
Wages	0	10	0
Tools and light	0	1	6
Fuel and lime	0	10	0
Carting refuse from boiler and sulphate plant	0	2	0
Bags and filling	0	5	4
Cartage to station, brokers' discount, and railway rate	0	16	0
Contingencies	0	2	0
Management	0	2	0
Total	5	9	4

The Extensions at the Aldershot Water-Works.

SIR,—My attention has been called to a paragraph on the Aldershot water supply, in the JOURNAL for the 1st inst., which is not quite accurate in its description of the proposed new pumping-station of this Company, nor of the day-to-day requirements of our supply. The 300,000 gallons of water there mentioned is not by any means a sufficient quantity for our present requirements, much less for our probable future demand. We lately on several occasions supplied upwards of 900,000 gallons a day; and the new station is designed to pump 2,000,000 gallons each 24 hours. The pumping power of the works, when thus complete, will be about 3,000,000 gallons per day, not 300,000 gallons as stated. We have nine tubes sunk into the chalk for this supply, at depths varying from 250 to 350 feet, not two as you specify.

A. F. WILSON,
Chairman and Engineer,
May 16, 1894. Aldershot Gas and Water Company.

[The paragraph referred to in the above letter was founded upon information supplied by the Contractors who are carrying out the new works; and the particulars we gave presumably related to the additions, and not to the entire works.—ED. J.G.L.]

Fresh Issue of Capital by the Shrewsbury Gas Company.—An extraordinary meeting of the Shrewsbury Gas Company was held last Friday week, at which the chief business was to authorize the creation and issue of new stock sufficient to produce £10,000 of additional capital. The Chairman (Mr. J. S. Phillips) explained that, although the present capital was considerable, a great part of it was locked up in plant and buildings; and while the Company always paid ready money themselves, so far as they possibly could, they were compelled to give four or five months' credit. Last year, too, they suffered from the coal strike. For twenty weeks they had great difficulty in regard to coal, and paid £2620 extra for it. The Board had therefore decided to lay in a larger stock than before, so as to provide against any possible contingency. This would have the result of locking up still more capital; and rather than borrow from their bankers, they were of opinion that fresh stock should be created. New mains were also needed, as well as some improvements at the works. The proposition of the Directors was agreed to; and they were also authorized to raise, if needful, a further £2500 by mortgage.

Probable Return to Gas for Street Lighting at Harwich.—The town of Harwich, which for some time past has been indifferently lighted by means of oil-lamps, is likely to return to gas. A report was submitted at the last meeting of the Town Council, stating that negotiations with the Gas Company had been opened; and it was hoped they would result in a satisfactory arrangement, whereby the lighting with gas could be resumed. An earnest advocate of the present system, Mr. Rose, moved a resolution opposing any additional burden being put on the ratepayers. The oil-lamps, he said, were certainly more trouble; but the lighting now cost £200 a year less, and he did not see why oil-lamps would not do. Mr. Bullimer seconded the resolution, and said the lamps would be all that was desired if better attended to. Mr. King pointed out that the borough had become ridiculous in the eyes of visitors by the use of paraffin lamps for street lighting. In his opinion, if the cost was £100 a year more for gas, it would be far better to have it. Alderman Durrant held entirely opposite views to Mr. King; and remarked that he had heard the Corporation complimented by many visitors, who said the streets were well lighted. Mr. Whitmore, however, said it was high time the lighting was improved. It was ridiculous to imagine, in an open town like Harwich, that the oil-lamps could be kept alight; and it would be a great improvement if the streets were again lighted with gas. Mr. Rose's resolution was rejected.

LEGAL INTELLIGENCE.

KENDAL COUNTY COURT.—Wednesday, May 9.

(*Before his Honour Judge* STEAVENSON.)

Kendal Gas and Water Company v. Atkinson.—Gas Supply by Automatic Prepayment Meters.

This was a case of special interest to suppliers and consumers of gas through automatic meters; and, though the amount in dispute—£1 12s. 6d.—was not large, the principle involved and the decision arrived at alike justify a fairly full report of the proceedings.

Mr. J. E. BOLTON appeared for the plaintiffs; Mr. G. E. CARTMEL represented the defendant.

Mr. BOLTON, in stating the case, said the defendant was supplied by the plaintiffs with a prepayment meter so arranged that, for every shilling dropped into it, he would receive, supposing the mechanism worked properly, 285 cubic feet of gas. If, however, the mechanism failed, he would either get no gas at all, or continue to receive it without depositing his shilling. In the present case, the meter appeared to have got out of order; and the defendant had gas without depositing the necessary shillings. Consequently, when the Company's collector went to take the money out of the drawer of the meter, he found much less than there should have been; and the question in dispute was whether the defendant was liable to pay the difference, amounting to £1 12s. 6d.

Mr. CARTMEL said his client merely disputed being called upon to pay the amount.

Mr. BOLTON said he would call witnesses to speak as to the reading of the meter and the price at which gas was being sold at the time; and he submitted that, if he proved these points, his friend must either show that the meter was incorrect—because it was assumed to be correct after having been stamped by the Government Inspector—or that another agreement was made with the defendant.

Joseph Knight, a collector in the service of the Company, was then called. He said that on Sept. 30 last year he collected from a prepayment meter at the public-house of the defendant, and there was £1 7s. in the drawer. There had been 8600 cubic feet of gas consumed, according to the index; and 100 was the figure at which the meter stood when it was put in. The value of the gas which had passed through was £1 9s. 9d., or 2s. 9d. more than was in the drawer. The meter was put in on the 9th of August; and that was the first collection. It was one of the first prepayment meters fixed in the town. On the 6th of November, it showed 19,100 cubic feet of gas consumed, or a consumption of 10,500 cubic feet since it was previously examined; the value of the gas being £1 16s. 9d. He took 8s. only out of the drawer. No one should be able to obtain access to the drawer but himself, as it was locked. He reported to the Manager that this discrepancy had taken place, and a fitter returned with him, and the gas was cut off the following day, when the meter indicated that 19,400 cubic feet of gas—300 feet more—had been burnt. There was no reason to suppose that the index was not working properly. From the date on which the meter was put in until the 30th of September, the average daily consumption was 165 cubic feet; and between that time and the 16th of November, the average consumption was 223 cubic feet per day. In the September quarter of the previous year, the average daily consumption was 133 cubic feet; and in the December quarter, 251 cubic feet was the average. He thought the automatic portion of the meter was not working properly when it was in defendant's house; and this was found to be the case when it was tested at the works after it was removed.

In cross-examination, witness stated that he would not like to say whether anyone was present when he took the measurement of gas used. He did not call anyone's attention to the first discrepancy. Notice was given to the defendant that the meter would be taken away after the second discrepancy; but, as far as he knew, defendant was not told that the meter was to be tested.

Thomas Bone, fitter in the employ of the Company, said he put the meter into the defendant's premises, and connected it. It bore the Government stamp. He examined it subsequently, and discovered small pieces of solder in it, which might have found their way there in the construction of the joints of the meter. Something afterwards went wrong with the automatic part of the meter; but, so far as he could see, the indicator was in good working order.

Mr. BOLTON said the onus of proof that the meter was incorrect lay with the defendant.

Witness, continuing, said he had known the automatic portion of other meters to go wrong, but not the indicator part.

Mr. *T. N. Ritson*, the Company's Manager, was the next witness. He said he knew something of the construction of automatic prepayment meters. The quantity of gas to pass through was marked upon them. If the automatic portion of the machine went wrong, gas would pass through without payment. The meter in question had been tested by a Government Inspector, who reported that it was 0·5 per cent. fast, which was in favour of the seller. When any discrepancy arose in connection with these appliances, it was the usual thing to get any deficiency of money from the consumers; and where too much had been paid, the surplus was refunded. He did not think the defendant was responsible for his meter going wrong.

John E. Iredale, bookkeeper at the gas-works, said he had tried the model automatic machine, and found that it did get out of order.

Mr. BOLTON said this concluded his case.

His HONOUR remarked that no contract had been proved; nor had it been shown conclusively that the meter was correct.

Mr. BOLTON said the fact of the defendant allowing the meter to be put in, and afterwards using the gas was sufficient contract; and as to the correctness of the meter, he could produce the certificate of the Government Inspector. He did not consider it necessary to bring him into Court, as the costs would have been greatly increased if he had done so.

His HONOUR said he should consider the question of costs according to the ground of argument and the line of the defendant's case. He thought it should be proved that the stamp was the Government one.

Mr. CARTMEL said he did not press for the attendance of the Inspector, if the costs would follow.

Iredale was then recalled, and said the defendant formerly had a penny prepayment meter; and he came to the office and asked for a shilling one instead. Witness took the order; and the meter was afterwards put in.

Mr. *Ritson*, recalled, said the meters were examined by the Government Inspector, for soundness and measuring capacity; and no gas could be passed through them without being indicated on the dials.

Bone was also recalled, and said he examined the meter to see whether the indicator was in proper working order, by passing gas through, and not to see if it registered the correct quantity of gas. So far as he could see, it was all right.

Mr. CARTMEL then submitted that the plaintiffs had not proved their case—first, on the ground of contract. The contract was for a shilling's worth of gas; and if the Company gave the defendant two shillings' worth for a shilling, he was not liable, on the simple ground that he was not in a position to know whether he had the gas wilfully or gratuitously. On the other hand, they had not proved that the meter was properly tested to see if it registered correctly. What they proved was that gas went through without money being put into the box; and it had not been alleged that his client had in any way tampered with the box.

His HONOUR said the defendant never contracted to take gas as indicated by the meter; and the Company's meter never indicated to him that there was more than a shilling's worth of gas passing.

Mr. BOLTON said that to ignorant men this would not appear; but a man who had the knowledge could read by the meter how much gas had been used.

His HONOUR pointed out that there was no contract to take gas beyond that bought with the shilling. Defendant contracted to pay ready money. What contract was there to take beyond the shilling's worth of gas?

Mr. BOLTON said the defendant had been in the habit of using an ordinary meter. His account was not satisfactory, and consequently the Company's Manager said he would not allow him to have gas unless he paid in advance; and he had a meter which would prevent him receiving gas before he paid for it. He would do all he could to supply him; but, as his account was unsatisfactory, he must prepay for it. He agreed to take an automatic meter; and he could see, if he wished, when he had received 285 cubic feet of gas. The money deposited in the drawer did not come into the hands of the Company until it was taken out by one of their servants; but it had been proved that the meters, which were in their infancy, did sometimes fail in their work. The collector went round to gather the money; and he read the index to ascertain if the amount which was in the drawer tallied with the quantity of gas used. The facts of the case showed what the action of the Company was. When they found the meter going wrong—supplying a greater quantity of gas than it should do—they took it away. This indicated that the intention of the Company was that, so long as the meter worked properly, and supplied only the 285 cubic feet of gas, the defendant should use it. There was no contract that he should receive as much gas as he could obtain for the money he put in; but only the 285 cubic feet for every shilling.

Mr. CARTMEL said the defendant was told the gas would be cut off as soon as the shilling's worth had been used.

His HONOUR said he considered the defendant was entitled to judgment. He thought there was a contract to take 285 cubic feet of gas for a shilling; and for every shilling that was subsequently put in the Company contracted to deliver this quantity of gas. If their meter was wrong, they must suffer, and not the consumer. This one was admittedly wrong; and therefore they should be the sufferers, and not the innocent person who took the meter, and knew nothing about it, and was willing to take it on trial. If one thought how carefully the Legislature had guarded against meters being wrong, it would be seen that, with regard to the common meter, the only thing that would make it conclusive between the parties was that it should be properly tested. There was nothing that said an automatic meter should be conclusive. As to the pure question of contract, the defendant's Solicitor urged a point perfectly correct, and, in his opinion, right. Defendant was entitled to judgment, because there was no contract between the parties to pay for the gas beyond the shilling's worth. He contracted to prepay, and had done so; and the Company could not recover for anything more.

Mr. BOLTON said the Directors felt strongly upon this matter; and if they should find it necessary to state a case, would his Honour give them permission?

His HONOUR said he could not do it then; but if they made up their minds to appeal, he would read his notes, and consider the matter. If he had sufficient notes, he would give them leave to appeal.

Mr. CARTMEL then applied for costs on the higher scale.; but his Honour declined to grant them.

NORTH LONDON POLICE COURT.—Wednesday, May 9.

(*Before Mr.* LUSHINGTON.)

East London Water Company v. Kyffin—The Recovery of Water-Rates.

To-day Mr. Benjamin Kyffin, a member of the Hackney Vestry, appeared in answer to nine summonses taken out by the East London Water-Works Company for water-rates due upon houses of which he is the owner.

Mr. G. KEBBELL appeared for the Company; Mr. C. V. YOUNG represented the defendant.

Mr. YOUNG raised an objection to two out of the four quarters' rates demanded, because the six months' limit had passed when the demand was made.

Mr. KEBBELL replied that the rate, which was payable in advance, was demanded for the six months between June and December, 1893, on Oct. 23. The demand was repeated in February; and the assistance of the Court was asked in March. Therefore he submitted that it was made in good time.

Mr. LUSHINGTON held that, as the rates were made in advance, the demand was out of time.

Mr. YOUNG next disputed the liability to pay the remaining two quarters, because they had not been properly demanded, but added to the original sum. He also submitted that proof of ownership should be given.

Mr. KEBBELL: Mr. Kyffin is assessed to the poor-rate in respect to these nine houses; and the rates were made strictly in accordance with the assessments.

Mrs. *Ford*, the occupier of one of the houses, was called; and she stated that she had paid her rent to Mr. Kyffin for the past two years.

Mr. KEBBELL: And he pays the water-rate—or, rather, owes it.

Witness (continuing) said she paid 11s. 6d. per week, equal to £29 18s. per annum.

Mr. *Gray*, Deputy-Accountant to the Hackney Vestry, produced the rate-books, from which it was shown that the house occupied by Mrs. Ford was assessed at £16. In explanation of this disparity between the rate and the assessment, witness said that, in cases where owners compounded, certain allowances were made. The houses would be assessed in accordance with the rental which was returned in 1890, at the preparation of the quinquennial valuation list, not at the present rental. The house was assessed to the poor at £16; thus making allowances for empties and repairs. There was a scale laid down by the London County Council governing these matters.

Mr. KEBBELL remarked that £13 18s. was a very liberal allowance.

Mr. LUSHINGTON said the objection in regard to the remaining two quarters' rates was fatal, as the usual formal demand was not made.

Mr. YOUNG asked for costs; but his Worship refused to allow them.

Wednesday, May 16.

(*Before Mr.* KENNEDY.)

Mr. KEBBELL attended the Court to-day, and lodged an appeal against the decision reported above. He explained to his Worship that four quarters' rates had been demanded, and that Mr. Lushington had decided that those for two quarters could not be recovered because the demand was out of time, and that the other two were not recoverable because they had not been demanded in the ordinary way. It was against the latter decision that the Company had decided to appeal, because they considered that there was nothing in their Act making the demand imperative.

The necessary sureties were given to prosecute the appeal.

LAMBETH POLICE COURT.—Friday, May 18.

(*Before Mr.* BIRON.)

The Charge for Water for Baths.

Mr. RIDDELL, Solicitor, to-day applied for a summons against the Lambeth Water-Works Company. He pointed out that it had been the practice of the Company to charge 10s. annually for each fixed bath; and that in a recent case (see *ante*, p. 714) Mr. Justice Chitty held that they were entitled to make this charge. Acting under this judgment, the Company had given notice to all those persons who had declined to pay the extra charge for baths that they would discontinue the supply; and they had, in fact, cut off the supply in many cases. He asked his Worship to grant a summons, under section 43 of the Water-Works Clauses Act, 1847, against the Company for the recovery of the penalties provided by that Act where a company neglected or refused to furnish a supply.

Mr. BIRON pointed out that Mr. Justice Chitty held that the Company were entitled to charge for baths, and that water for baths was not a domestic supply.

Mr. RIDDELL: That is so; but he did not hold that they had any statutory right to make the charge.

Mr. BIRON: To succeed on a summons, you would have to show that all proper dues that the Company were entitled to were paid.

Mr. RIDDELL: I am prepared to show that.

Mr. BIRON: No; you are not. You said you have not paid for the bath; and you wish now to contend before me that it is a domestic supply, which is exactly the point decided by Mr. Justice Chitty. I am pleased to say I am not a Court of Appeal from Mr. Justice Chitty; and I am bound by his decision.

Mr. RIDDELL: Our contention is that, whether the Company are or are not entitled to make this charge, they are not entitled to discontinue the domestic supply by reason of the non-payment of the charge for the bath.

His WORSHIP granted a summons.

St. Mary Church Local Board Gas-Works.—It was reported at the last meeting of the St. Mary Church Local Board that the balance-sheet of the Gas Committee showed a profit of £1036 on the past year's working; and this, it was stated, was one of the best financial results the Board had ever had in connection with the department.

Proposed New Water-Works for Horwich.—The rapid development of the town of Horwich, near Bolton, by reason of the establishment there of the Lancashire and Yorkshire Railway Company's works, has brought about the need of an extended or new water supply. The Local Authority have had the subject under consideration for some time; and they recently instructed Mr. A. M. Fowler, of Manchester, to examine and report upon the matter. Mr. Fowler has submitted five schemes; but he recommends the one which provides for the construction of a large reservoir on Smithills Moor, the water to be obtained from the tributaries of Deane Brook. The estimated cost of a reservoir to hold 36 million gallons, capable of supplying 200,000 gallons per day, he gives as £20,880, or 3·73d. per 1000 gallons daily. The Engineer suggests that the water from a storeage reservoir at Montcliffe Colliery, from which the Local Board get a supply of 150,000 gallons daily, shall be mixed with the new supply. He further suggests that the water obtained from the Blackrod works, 100,000 gallons daily, shall be conducted to the storeage reservoir. A Sub-Committee of the Local Board is now considering the scheme.

MISCELLANEOUS NEWS.

BRUSSELS MUNICIPAL GAS SUPPLY.

Gas Committee's Report for the Past Year.

The following is an abstract translation of the report of the Gas Committee of the Municipality of Brussels on the working of the gas undertaking during the twelve months ending Dec. 31 last.

The total quantity of gas sold was 24,645,880 cubic metres, or about 870 million cubic feet, exceeding by 738,000 cubic metres, or about 26 million cubic feet, the sales in the preceding year. The Committee regard this result as very satisfactory, considering the loss which has followed the starting of the central electric light station in the city, and the adoption of a large number of Welsbach burners. The production of gas amounted to 30,438,200 cubic metres (about 1076 million cubic feet); and it was disposed of as follows:—

	Cubic Metres.
Night gas, at 14c. per cubic metre	18,623,736
Day gas, at 10c.	3,168,457
Municipal establishments, at 10c.	895,475
Gas-engines at 10c.	1,274,278
Industrial purposes, at 10c.	382,180
Heating purposes, at 10c.	80,034
Illumination devices, balloons, &c.	186,234
Artizans' dwellings and miscellaneous	35,486
Total sold.	24,645,880
Public lighting and illuminations	3,857,912
Used on the works, &c.	955,492
Unaccounted for	978,916
Total production	30,438,200

The working expenses amounted to 3,181,211 frs. (£127,248), which were increased to 3,441,755 frs. (£137,670) by the expenditure of certain sums to order. The principal receipts were as follows: Gas, 3,210,968 frs.; coke, 788,129 frs.; tar, 156,293 frs.; ammoniacal products, 139,579 frs.; spent purifying material, 59,519 frs.—miscellaneous receipts (comprising rental of meters and fittings, &c.) making up a total of 4,817,889 frs. The balance in favour of the Municipality at the close of the year was therefore 1,376,134 frs. (£55,045). Deducting, however, 25,262 frs. for depreciation, the profit on the past year's working was, in reality, 1,350,872 frs. (£54,035). With regard to manufacturing operations, the averagecost of the coal carbonized was 18 frs. 9 c. per ton; being 1 fr. 98 c. less than in the preceding year. Exceptional circumstances enabled the Gas Committee to dispose of nearly the whole of their stock of coke; the quantity sold by retail reaching 1,755,684 bushels, as compared with 1,685,403 bushels in 1892. A tar distillery is in course of erection; and it will be brought into use at the close of the present year. The contract for the ammoniacal liquor will expire on the 30th prox., from which date the Committee will themselves undertake the manufacture of sulphate of ammonia. The spent oxide is regularly disposed of; the receipts arising from its sale last year amounting to 59,519 frs. The seventh gasholder was brought into use in November last. Plant for the manufacture of oil gas has been erected; and it will very soon be put into operation. The amount of capital employed in the gas undertaking at the close of the past year was 16,230,922 frs. (£649,237), as compared with 15,063,948 frs. (£602,558) at the corresponding period of 1892. The total length of mains was brought up to 164,868 metres (about 181,354 yards) at the close of 1893, as compared with 163,378 metres on Dec. 31, 1892; and of the total quantity of gas passing through them, only 3·22 per cent. was lost by leakage. The number of gas appliances of all kinds fixed last year was 1127; bringing up the total to 5582. There were 28 additional gas-engines fitted up; making the total number 243. The gas consumed for motive power reached about 45 million cubic feet last year. For the public lighting, there were in use on Dec. 31 last 5702 lamps, of which 494 were fitted with high-power burners. Of the latter, 468 were extinguished between midnight and one o'clock in the morning, as well as 396 ordinary lamps. The total number of hours' lighting was 3829.

THE NEW GASHOLDER FOR MIDDLESBROUGH.

At a recent Monthly Meeting of the Middlesbrough Town Council, the question of the construction of a new gasholder again claimed attention. It appeared that the Town Clerk had, since the previous meeting, informed Messrs. Ashmore, Benson, Pease, and Co. that the Corporation were willing to give them the order, subject to satisfactory arrangements being made as to the terms and the form of the holder, and that the firm had replied as follows: "After considerable thought on the subject of the new tank and gasholder, and after an interview with Mr. Terrace, we wish to strongly recommend the erection of a complete annulus tank as the only one reliable on the treacherous foundations at the Marshes. The advantages of the complete annulus are: (1) That, owing to its shape, it forms a strong girder or channel sufficient to bridge over any comparatively weak spots in the foundations. (2) A perfectly water-tight tank can be assured. (3) The excavations and the amount of concrete necessary are very much less in this design. (4) The concrete foundation of the annulus can be extended on each side so that the weight is distributed over a proportionately larger base than in the case of a flat plate bottom all over the area of the tank; while the annulus is 6 feet wide, the concrete will be 13 feet wide by 3 feet thick, or more if desired. We have made an estimate of the two schemes, and find that, with the annulus, the cost, though rather greater, is not much in excess of the other, owing to the fact that the excavation is much less and also the amount of concrete required. It is difficult to give figures without an exact knowledge of what will be required; but if carried out with a puddle bottom (to ensure gas-tightness) and an interior concrete wall, the cost will be about £5000. If these two are not required, the price would be reduced by about £700. The other scheme might be £500 or £600 less. The tender of £14,401 we have already sent is composed as follows: Holder, £7422; tank, £6979. We regret that we cannot undertake to have one lift ready for gas next winter." In a further letter, Messrs. Ashmore, Benson, Pease, and Co. stated that there would be an additional cost of £3455 extra cost of annulus, full height, and the cost to the Corporation of excavations, concrete foundations, &c., £1392, bringing up the total cost to £19,248, of which their contract would be £17,856. Alderman Bulmer moved that the resolution passed at the previous meeting with regard to the holder should be rescinded; but it was then suggested by Mr. C. L. Bell that, as the Gas Committee intended to visit Tyne Dock and inspect one of the new holders, the discussion of the question should be deferred. Alderman Bulmer, however, persisted in proceeding with his motion. He reminded the members that on a previous occasion, the Committee had decided in favour of letting the contract to the Whessoe Foundry Company, Limited, for an ordinary guided holder; and in his opinion the rope-guided holder which Messrs. Ashmore, Benson, Pease, and Co. proposed to erect was not a safe one. The tender was £15,400; but if afterwards the Corporation wanted columns erected, they asked £900 more, which would make it £21 above the price asked by the Whessoe Foundry Company. He did not know why the Corporation should experiment for the benefit of other people. Mr. Benfield seconded the motion, and said he believed from what he could learn that the Gas Committee proposed taking a very dangerous course. Alderman Archibald proposed, as an amendment, in view of the fact that the Gas Committee were about to inspect one of the new type of holder, that the consideration of the whole question should stand over till the next meeting. This was seconded, and ultimately passed.

BIRMINGHAM CORPORATION GAS SUPPLY.

The Affairs of the Committee—The Annual Accounts.

A Special Meeting of the Birmingham City Council will be held today to receive, among others, a report from the Gas Committee, with their accounts for the year ending March 31 last.

The Committee in their report state that a further expenditure of £3000 has been authorized, in addition to the sum of £700 referred to in the last report, for the completion of the remaining section of retorts in the new house at the Windsor Street works. In connection with this work, tenders have been accepted as follows: Messrs. Cochrane and Co., cast-iron fittings, £725; Messrs. Braithwaite and Kirk, wrought-iron ditto, £974; Messrs. Tangyes Limited, retort mouthpieces, £577. The Committee, not being satisfied with the sanitary arrangements at the Saltley works, have, on the advice of the Health Committee, sanctioned an expenditure of £900 in that direction; and about £400 of the total expenditure, being the cost of additional buildings to be provided, will be chargeable to capital account. The time having arrived for the reconstruction of a further portion of the retort-benches at the Swan Village works, the Committee have authorized an expenditure of £1950 for the purpose of rebuilding these benches in beds of seven instead of five—a considerable economy in manufacture having been effected in the portion of the retort-house which has been already so reconstructed. About £700 of the expenditure will be chargeable to capital account. Some of the firms with whom contracts for coal were made last year, having failed, on the termination of the coal strike, to resume full deliveries of coal, or to deliver the total quantity called for by the Committee of the arrears which had accumulated during the strike, the Committee claimed against them the differences in the cost of coal which had thereby to be purchased. Although these claims were in all cases at first objected to by the contractors, who denied liability for the default, they have all now been amicably settled; and the Committee have received the sum of £650 in discharge of them. On the resumption of deliveries of coal under the contracts made for the year's supplies, the Committee resold, for delivery elsewhere, a considerable portion of the coal which had been purchased in expectation of the continuation of the strike; and after deducting the sum received from contractors in default, the increased cost of coal purchased during the strike was reduced to about £15,000. The stock of coal on Dec. 31 was about 25,000 tons. The Committee have authorized an expenditure of £1500 in the enlargement of trunk mains for the completion of the work begun last year for the improvement of the supply in the north of the city, where the increasing use of gas-engines has necessitated this improvement. The Committee also report that, at the invitation of the Overseers, they had an interview with them on the subject of the increased assessment to the poor-rate in the parish of Birmingham, when the matter was discussed. After this interview, they were informed by the Overseers that they were willing to reduce the assessment. Although the amount of the offered reduction was not thought by the Committee to be sufficient to meet the justice of the case, they informed the Overseers that, having regard to the desirability of avoiding a contest between the Corporation of Birmingham and the Board of Guardians, they would accept the offer and withdraw the appeal. The Committee have since received notice of very largely increased assessments in the parish of Aston, which in some of the hamlets in this parish are relatively very much greater than the increased assessment in Birmingham. They, therefore, gave notice of their intention to appeal against the valuation lists. But, at the request of the Overseers, the notice was withdrawn; and it was arranged that, if the negotiations for settlement should fail, the appeal shall be renewed against the rate that has since been made on the increased assessment. The Committee further state that they have accepted the suggestion of the London and North-Western Railway Company that, instead of paying a percentage on the claims of the Company against the department under the revised rates for materials delivered to or from the works, they should, until the disputed rates are finally determined, pay a sum equivalent to the charges which would have been made under the rates in force to the end of 1892. After this arrangement was made, the Committee received a request from the Midland Railway Company

for an immediate remittance of the balance which had been withheld by the Committee in making payments to them of a similar percentage for carriage under the revised rates. They thereupon offered to adopt the same arrangement with the Midland Company as that which had been agreed upon with the London and North-Western Company. This proposal was met by a renewed request for payment; and by the statement that colliery owners and merchants generally were paying under the new condition of things—the few who at first objected having agreed to do so on its being shown that continued refusal would only lead to stoppage of the credit account. To this renewed request the Committee replied, repeating their offer, but at present have received no further communication from the Midland Company on the subject. While the Committee would be glad to see this matter disposed of, they say they do not feel justified in paying the largely increased rates which have been charged to them since Jan. 1, 1893, until, at least, they have had a suitable opportunity of bringing these rates before the notice of the proper tribunal—the more especially as the increased rates on coal delivered to the gas-works have not been reduced on the Midland Railway to the equivalent of the former rate, as they have been on some of the other railways.

The Committee submit their balance-sheet and statement of accounts for the year ended March 31 last, which show a net profit amounting to £24,551; and they recommend that the balance of net profit shall be appropriated to the improvement rate of 1893. They have informed the Finance Committee that they estimate the net profit for the year ended March 31, 1895, at £25,000, in addition to the interest of £4000 on the reserve fund. The cost of the repair of meters for the year has been £5936; and the number repaired was 8434.

The following are the principal items (shillings and pence omitted) of the revenue account, preceded by those of the previous year:—

Expenditure.

1892-93.	Manufacture of gas—	1893-94.	
£262,059	Coals	£260,724	
12,061	Purifying materials and wages	10,580	
5,102	Salaries at works	5,336	
59,303	Wages at works	59,458	
44,514	Repairs and maintenance	63,976	
			£400,075
	Distribution of gas—		
12,154	Salaries in light office	£12,404	
15,380	Repairs, maintenance, and renewal of mains and service-pipes	17,736	
6,176	Repairing, renewing, and refixing meters	6,720	
			£36,860
2,846	Lighting and repairing public lamps		2,987
18,581	Rent, rates, and taxes		21,899
9,376	Management		8,844
3,317	Law and parliamentary charges, bad debts, bank charges, &c.		1,750
£450,874	Total expenditure		£472,423
122,007	Balance carried to profit and loss account		123,286
£572,881			£595,709

Receipts.

£450,067	Sale of gas	£455,915
117,836	Residual products	135,295
1,988	Rents	2,075
1,744	Fittings	1,171
1,244	Discounts and transfer fees	1,241
£572,881		£595,709

Included in the total receipts from the sale of gas are the following items: Common gas, 1,295,430,500 cubic feet, at 2s. 7d. and 2s. 10d. per 1000 cubic feet, £172,042; ditto, 538,685,200 cubic feet, at 2s. 5d. and 2s. 8d., £67,549; ditto, 1,910,714,600 cubic feet, at 2s. 3d. and 2s. 6d., £223,613; and public lighting and under contracts, £13,790.

STAFFORD CORPORATION GAS AND WATER SUPPLY.

Annual Reports of the Gas and Water Committees.

At the Meeting of the Stafford Town Council on the 8th inst., the Gas Committee presented their report for the past financial year. It stated that to many gas undertakings the great coal strike had been most disastrous. But happily—thanks to their excellent Manager (Mr. J. Ferguson Bell)—the Committee had been able to avoid the necessity of raising the price of gas, as in so many instances had been done. Notwithstanding other adverse influences, they had to report an amount of profit which, although less than in previous years, was very gratifying. The quantity of gas delivered was nearly 126 million cubic feet; being about 5 millions more than in the previous year, and more than double the quantity sold when the Corporation acquired the undertaking some 16 years ago. The total receipts were, for gas, £15,475; and for residuals, &c., £4597—together, £20,072. The total expenses were £13,173; leaving a gross profit of £6889. Coals cost £4899 more than in 1891-2; and tar realized £161 less. Interest, sinking fund, and income-tax required £321 more; and rates were £112 heavier. On the other hand, there was a net increase from the sale of gas of £507; coke yielded £503 more; and sulphate, £221 more. So that the increased price of coal was not an unmixed evil. Out of the gross profit there had been paid £5448 for the sinking fund and interest, and £192 for income-tax; thus leaving £1259 net profit, which, with the balance brought forward, made £1265 to be dealt with. The Committee recommended that £1000 should be paid to the district fund in relief of the rates, that £250 be added to the reserve fund, and that £15 be carried forward. The total amount paid in relief of the rates would now be £23,850, and £20,945 towards the extinction of the debt. At the present rapid rate of repayment, the Committee would, within the next 20 years, have cleared off the whole of their present liabilities; and, if no further capital expenditure was incurred, they would be entirely free from debt. During the past few years, they had not only reduced the price of gas and increased the amount of discounts, as well as abolished meter-rents, but they had also reduced the hours of labour of the workmen—at the same time paying them higher wages—so that it could scarcely be expected that they should be able to hand over such large sums towards the rates as formerly. Still they thought that they had apportioned the profits equitably, and that workmen, gas consumers, and ratepayers alike had every reason to be satisfied with the results obtained up to the present time. The works were in a high state of efficiency; the contracts for the year were well placed; and the Committee looked forward with every confidence to the future of the undertaking.

Alderman W. H. Peach, in moving the adoption of the report, said that the gas delivered during the last month amounted to 8¾ million cubic feet; being an increase of 679,000 cubic feet, or almost 8½ per cent. The average illuminating power was 17·60 standard sperm candles. Referring to the annual report, he stated that the gas made for the year amounted to about 126 million cubic feet; and to produce this quantity 14,125 tons of coal and slack had been used—the make being about the same as last year. The gas unaccounted for amounted to 9¼ million cubic feet, or 7½ per cent. of the total make—so that some customers must have had more through their meters than was charged for. The total capital expended up to date, including the purchase of the works, was £103,467; and the capital account now stood at £81,637—the difference between the two being the amount of loans repaid (£20,945) since the transfer of the works, and the sum of £884 which had been spent on fixed plant more than was borrowed. The total sales of gas during the twelve months amounted to £16,125, out of which £651 had been allowed for discounts; leaving a net rental of £15,474, which was an increase of £507. Dealing with other items in the report, Alderman Peach alluded to the increase in the yield of coke and sulphate; and he mentioned that Mr. Bell was now engaged in experiments which, it was hoped, would enable the Committee to report a considerable improvement on the present satisfactory figures, provided the price of sulphate kept up as well as it had done in the past. The total revenue from all sources was £22,528; being a net increase of £1056. Rates and taxes amounted to the very large sum of £780; showing an increase of £112. The amount transferred to the depreciation fund was £1021; being £80 more than last year. The gross profit was £6899; being an increase of £340. In conclusion, he said the Committee recommended the acceptance of the tender of the Harecastle and Woodshutts Colliery Company for the supply of 5000 tons of coal, 3000 tons of nuts, and 5000 tons of slack during the ensuing year. In accepting this tender, they had departed somewhat from the usual course by putting all their eggs in one basket, and getting nearly all they required in one contract. He was not at liberty to name the price, because the contractors had stipulated that it should not be mentioned. The tender was a very satisfactory one; and the coal was such as they had tried before. They asked the Council to place a tender for 13,000 tons of coal out of 15,000 tons required, which could be stored in the summer months.

Alderman Silvester seconded the motion; and it was carried.

The report of the Water Committee for the year ending March 25 last, was also presented. The revenue account showed a total expenditure of £1320, as compared with £922 in the preceding year. The total income was £2968, as against £2149 in 1892-3—being an increase of £819. This increase was almost entirely made up of £541 in the rental for domestic supply, £120 for non-domestic use, and £155 for the service outside the borough. These gave a percentage of increase of 47, 15½, and 79 respectively. The total of the rental for the year showed an increase of 38¼ per cent. The gross profit, after making the extra provision for depreciation and salaries, was £1648, or £421 more than that of the preceding year. During the twelve months covered by the report, £1393 had been paid for interest. There was thus an available balance of £255; and it was recommended that £150 be carried to the reserve fund, that £100 be transferred to the district fund for credit of the general district rate, and that the balance be carried forward. The number of additional premises to which the water had been laid on during the year was 1046, making a total of 3672 supplied, or an increase of nearly 40 per cent. About 98 million gallons of water were raised from the well at Milford during the year. Of these about 18½ million gallons were used for watering streets, flushing sewers, &c., for baths, public institutions, public fountains (free), manufacturing purposes, &c.; leaving the consumption for domestic purposes at 79½ million gallons, or a little more than 10 gallons per head per day for an estimated population of 21,500; and the non-domestic consumption at about 2½ gallons per head per day. The mains were extended during the year; and the works were maintained in a thoroughly efficient condition. There was no diminution in the quality or the supply of water. The Committee recorded their high appreciation of the management of the works by the Engineer (Mr. W. Blackshaw), and of the way in which the financial arrangements and accounts had been carried out by the Borough Accountant (Mr. Parker).

Alderman Lloyd, in moving the adoption of the report, congratulated the Council that the water-works were able to bear their own expenses. Many of those present, who had weighed over the disappointments of years gone by, would now have great pleasure in seeing one of the Corporation departments paying its way, contributing towards the depreciation of its property, and helping in the relief of the rates.

Alderman Amies seconded the motion; and it was carried.

NEWBURY CORPORATION GAS SUPPLY.

The Working in the Past Financial Year.

At the Meeting of the Newbury Corporation last Tuesday—the Mayor (Mr. J. Elliott) in the chair—the report on the working of the gas undertaking in the year ending the 25th of March last was under discussion.

The accounts of the Gas Department for the above-named period, as certified by Messrs. Alfred Lass, Wood, and Co., show that the sale of gas for public and private lighting produced £5517; rental of meters and stoves, £147; and residual products, £1099—making a total of £6763. The principal items of expenditure were: Manufacture (including £3061 for coals), £4182; distribution, £334; management, £169—the total expenses amounting to £5378. The balance carried to the profit and loss account was therefore £1385. The surplus on the year's working, with the balance brought forward, was £169, of which £100 had been written off distributing apparatus. In

their report to the Committee, Messrs. Lass remarked that it was estimated that the profit for the year had been adversely affected to the extent of £300 by the coal strike; and they pointed out that a sinking fund must be created to pay off the £3000 borrowed last year. The amount required for this purpose would be £66. With regard to the manufacturing operations, which are under the supervision of Mr. R. M. Couper, the quantity of coal and cannel carbonized during the twelve months was 2805 tons; the make of gas being 27,610,000 cubic feet, of which 25,780,700 cubic feet were accounted for. The residual products were: Coke, 2805 chaldrons; breeze, 29 chaldrons; and tar, 25,844 gallons. From the ammoniacal liquor, 21 tons 2 cwt. of sulphate were made.

Mr. LUCAS, in moving the adoption of the report, said it came to him as an agreeable surprise, because they were all looking forward to a possible deficit on the year's working. The accounts showed that the profits would be sufficient to pay all the necessary outgoings, sinking fund, interest on bonds, and other charges on the undertaking, and then leave a net balance of £148 19s. 10d., of which £100 had been written off the account for old plant pulled down. The unfortunate coal strike told against them. If they had had a fair year, they would have had a surplus of £500 to deal with. The sales of gas had been about 250,000 cubic feet, or 1 per cent. less than in the previous year, which was accounted for by the abnormally bright weather. Alluding to the working expenses, he pointed out that under the old *régime* in 1881 the amount was 2s. 7½d. per 1000 cubic feet of gas sold, whereas now it was only 1s. 7¾d. It cost very little more now to manufacture and sell 26 million cubic feet of gas than it did to turn out 17 or 18 millions in 1881. This was a result on which they could congratulate themselves. When they erected their sulphate works, it was an open question whether it was an advisable thing to do; but the Gas Committee considered it was advisable, and they had been justified in their opinion, as they had made a profit of £166 10s. on the works—something like 35 per cent. on the total cost of the building and plant. He thought they would agree that this was a satisfactory result. He remembered that, on previous occasions, when the gas report had been before the Corporation, some members had spoken of no dividend being paid. It was an extraordinary thing that any member should make use of such a term. They did not have a dividend; but they paid interest to bondholders, and met other charges on the undertaking. As a matter of fact, the profits now made were just over 5 per cent. on the capital employed. The bank account had been overdrawn to the extent of £2120—an increase of £1000 on the previous year; but it could be accounted for. They had spent £500 in excess of the £3000 borrowed for new works; they owed tradesmen £1179 instead of nearly £1600, as at the close of the previous year; and they had a larger stock of coal amounting to £1071. He thought that in the current year they might look forward to reducing the overdraft by half. Referring to a recommendation to pay off £1500 on bonds, he explained that their original borrowing powers were £25,000, of which they had already paid off £1500. The sinking fund now stood at £1634; and it was proposed to sell out sufficient to pay off another £1500. The effect would be that, as they had to pay 2¾ per cent. interest upon the sinking fund, instead of 3½ per cent. to the bondholders, a saving of £12 per annum would be effected. If this were agreed to, they would have paid £3000 off the original £25,000. They had borrowed an additional £3000; so that notwithstanding the improvement and extension of the works, their capital stood at the same figures as in 1881.

Mr. STONE seconded the motion.

Mr. WITHERS characterized the statement of the Chairman of the Gas Committee as extraordinary. He said there was a decrease of a quarter of a million cubic feet in the sales of gas, which the Chairman had attributed to the absence of fogs. He (Mr. Withers) put it down to the poor quality of the gas supplied, and the cheapness of oil. He considered that, after deducting the £66 to be set aside for the repayment of the £3000, the real balance would be £3 4s. 2d., which, although it might be regarded as satisfactory by the Chairman, was not to himself, nor would it be to the general body of ratepayers. It had been shown that a reduction of 11¾d. had been made on the make of every 1000 cubic feet of gas; and the saving thus effected should have resulted in a much larger balance of profit. The Chairman said it cost but little more to produce 26 million cubic feet now than it did 17 or 18 million feet in 1881. Therefore they ought to have the price of gas reduced. He knew it had been lowered to 4s. 6d., less 4d. for discount; but at other places the price had gone down considerably. Although the cost of coal had been increased during the strike, the price obtained for coke had been higher, and the returns from residuals should have counterbalanced the higher price of coal. The overdraft at the bank had been increased by £1000, which the Chairman had been able to explain away; but it was nevertheless most unsatisfactory. They were making gas at less cost, but not reducing the price in proportion; they did not pay so much interest—or dividend, call it which they liked—but still they went on borrowing. He should move, as an amendment, that the gas undertaking was in a very unsatisfactory state.

The MAYOR considered the accounts of the Gas Department needed serious consideration. At the end of ten years, the Corporation were still in the position of owing £25,000. They had extended the works and improved the plant; and they ought to increase their sales.

Alderman JACKSON seconded the amendment. He said the gas undertaking had been working for twelve years, and they were no forwarder than when they started. There was no excuse for the falling off in the sale of gas; and as to the extra £300 paid for coals, there was an increase of £160 on residuals, so that this item was reduced to £140. He believed the undertaking to be in an unsatisfactory condition; and he did not think, in the hands of those now conducting it, it would ever be a profitable concern to the borough.

Mr. KNIGHT said the balance-sheet appeared to him to be a favourable one, and compared well with that for the preceding year. The members seemed to have lost sight of the fact that the Committee had been at great disadvantage owing to the increased price of coals. They anticipated a deficit of £500; and they had done the best they could in the circumstances in which they were placed. If the report was unfavourable next year, he should most likely want to know the reason why.

Mr. MIDWINTER said he was glad to hear such an emphatic expression of opinion from a member of the Committee—more especially as Mr. Knight had previously criticized the condition of the undertaking. It seemed to him that the reduction of the working expenses from 2s. 7½d. to 1s. 7¾d. per 1000 cubic feet of gas sold was a very solid fact, and required their careful consideration and appreciation, as did also the fact that the price of gas had been reduced to 4s. 2d. On the whole, he thought the management had been very successful; and, considering their difficulties, the Gas Committee were entitled to the warmest thanks of the Corporation.

Mr. HARRIS said the real test of good management was the working expenses; and in 1881 they were nearly double what they were now. He felt sure the next report would be a satisfactory one; for, with good plant, they would be able to make gas as economically as any similar works in the kingdom.

Mr. LUCAS, in reply, said one of the obstacles in the way of the undertaking was that members of the Corporation used oil instead of supporting their own gas undertaking. It was rather extraordinary that Mr. Withers should burn oil, and then come to the meeting as a gas critic. That gentleman had, however, fallen into so many blunders that he had not time to pull him out. He then went on to say that the works were enlarged on the report of Mr. W. A. Valon, and that the responsibility for this rested upon the Corporation, and not upon the Gas Committee. He reminded Alderman Jackson that in 1881, when the working expenses were 2s. 7½d. per 1000 cubic feet, they were paying less for their coal by 3s. or 4s. per ton; and it must not be forgotten that the price of gas had been reduced to 4s. 2d. This was £1500 a year in the pockets of the consumers; and they had spent £5000 or £6000 out of profits in laying new mains and extending the works, as well as £3000 in improvements. They had an undertaking which was worth £8000 more than in 1881; and yet they owed no more money.

Mr. WITHERS explained that he burned oil because it meant a considerable saving to him. He thought the benefit of the ratepayers should be considered, and not that of the gas consumers only. A large body of ratepayers were not consumers, especially the working classes.

The amendment was then put; and, only two voting for it, it was lost. The report was then adopted by 9 votes to 2.

GEORGETOWN (BRITISH GUIANA) GAS COMPANY.

The Half-Yearly Meeting of this Company was held last Tuesday, at the London Offices, 30, Gracechurch Street, E.C.—Mr. ALFRED WILLIAMS in the chair.

The SECRETARY (Mr. S. Wood, F.C.A.) read the notice convening the meeting; and the report and accounts, to which allusion was made in the JOURNAL for the 8th inst., were taken as read.

The CHAIRMAN, in moving their adoption, remarked that the profit for the past half year had amounted to less than that of the preceding half year. This arose from one or two causes. They were, at the time of the previous report, in a state of transition—giving up some of the public lamps to the Town Council, who were going to supply them with electricity. They also had a little extra cost in coal to cover; and they had met with a small accident. This had reduced the profit. Taking the three past half years, at the end of December, 1892, the profit was £1079; at June, 1893, it was £1085; and for the last six months, it was £901. They had therefore lost, as nearly as possible, £180. The Directors were obliged to meet this; and they did so in the most sensible way, by not dividing more than they had earned. He thought the shareholders would agree that this was the proper course to follow. Having referred to the dividend, the report proceeded to say that "the business of the Company has somewhat decreased since electricity has been employed for public lighting"—that was up to Dec. 31 last. Since that time, however, the whole of the public lighting had been transferred from the Gas Company to the Electric Lighting Company, and some outlay had been incurred in taking up the services and the mains which were not now required. This might further affect their profits for the next half year. However, he hoped it would not be so, because the Directors had taken the precaution to reduce the price of gas to a uniform charge over the whole of Georgetown. The reports received from the Company's local Director (Mr. G. R. Garnett) and their Engineer and Manager (Mr. T. B. Younger) stated that they fancied—he hoped the fancy would turn out true—that gas-stoves for cooking and heating would come largely into use, and that from this source they might recover some of the income which had been lost.

Dr. WOODS, in seconding the motion, asked whether he understood correctly that loss had been incurred in consequence of an accident.

The CHAIRMAN replied that the accident to which he had referred occurred to their foreman's property, through a fire in an adjoining foundry. They had also had a serious loss on tar; and there had been a heavy leakage of gas, owing to the cutting off of the public lamps.

The motion was unanimously adopted.

On the proposition of the CHAIRMAN, seconded by Mr. C. GANDON, a dividend for the half year was declared on the preference share capital at the rate of 8 per cent. per annum, and on the ordinary share capital at the rate of 5 per cent., both less income-tax (except upon the dividends payable to the local shareholders).

Mr. BLYTH moved the re-election of the Directors retiring by rotation (Messrs Williams and Lass). Mr. J. MANWARING seconded the motion, which was agreed to.

The retiring Auditor (Mr. Manwaring) having been reappointed,

The proceedings concluded with votes of thanks to the Secretary (Mr. S. Wood), the local Secretary (Mr. F. A. Conyers), the Engineer (Mr. T. B. Younger), the Auditors (Messrs. Magnus Ohren and Manwaring), the Solicitor (Mr. E. K. Blyth), and to the Chairman and Directors; special mention being made of the difficulties which the officials had had to face during the past half year.

Petroleum in Somerset.—The hope of utilizing the discovery of petroleum on the Ashwick Estate, in Somerset, is not abandoned. A Syndicate has been formed, and leases signed giving them mineral rights over 1200 acres. Several sites have been selected for boring.

THE FOLKESTONE ELECTRIC LIGHTING SCHEME.

Rejection of the Proposal.

We have referred on several occasions lately to the proposal submitted to the Corporation of Folkestone, by a Special Committee who had considered the matter, to adopt a scheme of electric lighting, at an estimated cost of £35,000. The scheme was, it may be remembered, vigorously opposed by Mr. Daniel Baker, one of the members of the Town Council, who brought up in his support some carefully prepared statistics. After many discussions, the question was decided at a meeting of the Council on the 6th ult., when a resolution in favour of the proposal was adopted. It was subsequently submitted to a public meeting of ratepayers; and its abandonment was emphatically called for. In view of this expression of feeling, it remained for the Corporation to confirm or rescind their resolution. A meeting was accordingly held for the purpose on the 10th inst., under the presidency of the Mayor (Mr. Vaughan). A feature of the previous debates was the ruling by the Town Clerk that no member of the Council having an interest in the Gas Company's affairs could "take part in the discussion of, or vote upon," the electric lighting question. This ruling was, however, disputed; and the objection was renewed at the very outset of the proceedings last Thursday, by Alderman Banks, who is interested in the Company, bringing forward a motion and proclaiming his intention to vote upon it. After this incident, the Mayor proceeded to pass in review the various steps that had already been taken. He said that, since the scheme had been sanctioned on the 6th of April, the inhabitants had declared against the proposal. The scheme had had several stages—£75,000 with a dust destructor, £67,000 without a destructor, and eventually £35,000. Originally one petition in favour of the lighting was received from 166 memorialists, many of whom were now opposed to it; and a competent authority had stated that a scheme for £12,600 would meet all local requirements. Public opinion was dead against an expenditure of £35,000. A public meeting had declared unanimously against it; while some of those who had been in favour of electric lighting had turned round upon it. Therefore, under all the circumstances of the case, he felt it his duty to move—"That the resolution passed on the 6th of April be revoked." Mr. Salter at once seconded the motion. Mr. Logan moved as an amendment, that the Corporation adjourn the matter for a month, on the understanding that, during the interval, Mr. Baker should lay the details of his £12,000 scheme before them. If, he said, for £12,000, Mr. Baker was going to do as much as the Committee could do with a £35,000 scheme, the town would hail him as a benefactor, and would be placed under a debt of eternal gratitude to him. Mr. Tolputt, in a facetious sentence or two, seconded the amendment. Mr. Baker accepted the challenge, but on the condition that, as a prior step, the Committee's scheme should be swept out of the way. Then, if the Corporation so desired, he would, he said, be pleased to bring the whole thing before them; but it was, in his opinion, perfectly ridiculous and useless to submit it to the Electric Lighting Committee, as they were wedded to their own scheme and committed to the electrician whom they had consulted. A professional gentleman had given him the figures—they were not his own; but they must get rid of the Committee's scheme first. A somewhat excited discussion followed, at the close of which the amendment was defeated by a majority of two. The Mayor's motion was then put, and carried by nine votes to six.

SUGGESTED IMPORTANT IMPROVEMENTS IN THE ROTHERHAM WATER SUPPLY.

The Water Committee of the Rotherham Corporation have had before them a lengthy and interesting communication from their Chairman (Major W. L. B. Hirst, J.P.) on the question of obtaining a water supply from the vicinity of Canklow. For some years the increasing population has rendered it necessary for the Corporation to augment the sources of water supply, and the condemning of the Wellgate Spring as polluted has increased their difficulties. Major Hirst, referring to the advisability or otherwise of utilizing the water known to exist in the sandstone strata at Canklow, suggested that the necessary details of engine and engine-house, &c., shaft, and all other works appertaining to the carrying out of the works, with plans, bills of quantities, and specifications be entrusted to Mr. C. E. Rhodes or to some other eminent engineer to prepare, and that contracts be at once advertised for, provided a suitable site was found. He further proposed that a Manager of the water-works should be appointed to devote the whole of his time to the duties of the department. At present the works are being managed by the Gas Engineer; but considering that the works stand in the ledger at no less a capital than £150,000, that the turnover receipts from all sources is £9236 per annum, and the total payments £9779 per annum, in his opinion they should have a practical and responsible man to look entirely after them. Should his various suggestions be carried out, he is convinced that, instead of a loss on the undertaking, a profit will be made in the near future. With reference to the Dalton reservoir, Major Hirst strongly advises the Corporation to apply to Parliament for an extension of time of (say) 15 years, as, if the reservoir is not constructed, the present Act of Parliament compels the Corporation to either ask for a further extension, or lose their water rights. He furnishes figures showing that the total yield of water from all sources from March 16 to April 13 has been 5,017,000 gallons, as compared with 7,660,000 gallons last year, and that the Ulley reservoir when last gauged, on April 14, only contained 107,000,000 gallons. If the dry weather continues, and a hot summer follows the last dry one, as the springs fail, unless the Wellgate water is used, a constant supply, he says, cannot be maintained. Mr. Rhodes, reporting upon the subject, says he has carefully considered the question of obtaining a supply of water for domestic purposes from the strata in the neighbourhood of Canklow. In the first place, the suitability of the water for drinking purposes will, he remarks, have to be decided; and therefore he thinks it best to make that the primary question for consideration, before going into other matters upon which he has been asked to report. In order to enable an accurate and reliable conclusion to be formed on this most important point, two samples of water have been taken by him from a depth of 30 yards below the surface. One of these he submitted for analysis to Mr. A. H. Allen, of Sheffield; and the other was sent by the Corporation to Professor Frankland. The two analyses bear one another out in one very important fact, and unfortunately that is that the water does obtain, from some source or another, animal contamination, and is not considered by either of these authorities as being suitable for dietetic purposes. Mr. Rhodes does not see where such a source of pollution can arise, and says it is possible that the water may have been contaminated by animal matter gathered in the immediate neighbourhood of the colliery from whence the samples were taken. He therefore strongly advises the Corporation, before doing anything further in the matter, to have a thorough inspection and report from Professor Frankland. With regard to the probable supply of water, he states that there is no doubt whatever that a very large quantity would be available, and could be brought into service at a very moderate outlay, as an adjunct to the existing supply, or auxiliary to any future supplies the Corporation might arrange to obtain elsewhere. Without going into details at the present time, he should—assuming the Corporation elected to proceed with the scheme—recommend the sinking of a well 9 ft. or 10 ft. in diameter on a site which he thinks would be very suitable for the purpose, and which would obviate the necessity for the purchase of minerals to support any machinery the Corporation might put down for pumping purposes. The Committee have decided to make further inquiries as to the advisability of using the water from the red sandstone strata by boring operations and subsequent analysis; and they have also resolved to ask the Sheffield Corporation whether they could supply Rotherham with water in case of emergency. The Committee further intend to request Parliament to allow an extension of time with regard to the Dalton scheme.

Huddersfield Corporation and the South Crosland Gas Company.—The Huddersfield Corporation, at their meeting last Wednesday, resolved to supply gas to the South Crosland Gas Company for their district at 2s. 9d. per 1000 cubic feet, subject to a discount of 5 per cent. if paid for in the usual time, and provided that the Company supply consumers at a rate not exceeding 4s. per 1000 feet.

Totnes Gas Company.—At the recent annual meeting of shareholders in this Company, the Directors reported that, owing to their early purchase of coal last year—notwithstanding that gas was reduced in price—they were able to recommend the usual dividend of 10s. per share, and a bonus of 2s. per share. The report was unanimously adopted; and the retiring Directors were re-elected. Thanks were passed to the Chairman (Mr. G. Mitchell), and to the Secretary and Manager (Mr. S. Samuel), for their efficient services during the year.

The Bridgnorth Town Council and the Divining-Rod.—The members of the Bridgnorth Town Council who expected great results from the employment of Mr. Mullins, who searches for water with the aid of the divining-rod, have been disappointed. The Water Committee reported at the last meeting of the Council that they had exhausted the amount placed at their disposal for the purpose of sinking the well. They had found, at a depth of 36 feet, a spring which yielded from 40 to 60 gallons of water per hour; and they were now considering whether it would be advisable to utilize the water in augmentation of the present supply. The adoption of the report having been moved and seconded, Mr. Beach again attacked the Council over their action in employing the divining-rod to search for water, and maintained that this well did not yield anything like the quantity that it was stated to do. He concluded by moving, as an amendment—"That the Town Clerk be instructed to communicate with the Public Prosecutor with a view of taking proceedings against Mr. Mullins for obtaining money by false pretences." This, however, did not obtain a seconder; and the report was adopted.

The Alleged Nuisance from the Electric Light Works at Morecambe.—At the recent annual meeting of the Morecambe Local Board, the Secretary (Mr. J. Jowett) and the Engineer (Mr. T. Preece) of the Morecambe Electric Light and Power Company attended with reference to the alleged nuisance arising from the Company's works (see *ante*, p. 721). Reports on the matter had been presented to the members of the Sanitary Committee by the Medical Officer of Health (Dr. Watterson), who was present, and the Surveyor (Mr. J. Bond); and upon these the Committee resolved to recommend the Board to take proceedings against the Company; but to first of all invite the Secretary and Engineer to attend, with the view of satisfying them that the nuisance would be forthwith abated, and efficient steps taken for preventing its recurrence. The reports having been read, Mr. Jowett said the difficulty had been that the complaints were not specific ones; and he argued that the Medical Officer's report was not sufficiently clear as to the cause of the alleged nuisance. The statements made by the deputation which recently waited upon the Board were false all round. He denied that the Company's men had to leave their employment owing to the evil effects of their work; and he said that the smells complained of might just as easily come from the gas-works. If the Electric Light Company were to be summoned, why should not the larger concern be proceeded against. Mr. Preece corroborated Mr. Jowett's statements as to the complaints not being specific, and as to the possibility of the smells arising from the gas-works. A member of the Board said that the gas-works were in position before the neighbouring houses were built; and another said the case was quite different from people whose property had been depreciated 50 per cent. in value by the electric light works. Mr. Jowett said this was a gross exaggeration; and he contended that the rents were being advanced. The Chairman (Mr. Lee) remarked that all the members seemed to be convinced that there was a nuisance; and the opportunity had been given to the Company to say what they were prepared to do, and not to argue as to whether or not there was a nuisance. After a great deal of discussion, Mr. Preece expressed a desire to go into the thing thoroughly; and it was ultimately agreed that he and the Medical Officer and Surveyor should meet and consult on some occasion when the nuisance was perceptible.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Reliable data as to the working of the Peebles oil-gas process are now available. Although not the first place to introduce the process, it is from Perth that the first results are announced. There is this to be said, however, that as yet the working results of a whole year are not given. So far as my recollection goes, Galashiels is the only place outside Peebles where it has been worked for more than a twelve-month. Mr. Whimster has, however, used the process during nearly the whole of the past lighting season; having inaugurated it in November. During that time, he has carbonized 295 tons of oil, from which he derived 6,738,920 cubic feet of gas, which is a yield of 22,825 cubic feet per ton of oil. The result is better than was expected. When Mr. Young first announced his process, he stated that 21,000 or 22,000 cubic feet of gas would be obtained by it; and Mr. Linton, in his report to the Edinburgh and Leith Gas Commissioners, in April, 1893, stated the yield as 21,959 cubic feet. This is satisfactory; and if the working in other places turns out as well, the process will be at once established as one of the permanent parts of a gas-works. This must be a great gratification to Mr. W. Young, the inventor, as it is only eighteen months since it was first placed before the public, and not yet a year since it was open to him to grant licences for the working of the process. Mr. Whimster reported to the Gas Commission on Monday, that the total gas made during the year was 96,567,600 cubic feet; being 966,000 cubic feet less than that made in the preceding year. The average of gas made per ton of coal, including tar, was 10,057 cubic feet; and the average illuminating power was 27·57 candles. The coal carbonized during the year, after deducting quantities used as fuel, was 8916 tons. The quantity of gas made from coal was 89,828,680 cubic feet. The financial results have not, of course, been as yet arrived at. Mr. Whimster also reported that, should the consumption of gas increase at the rate at which it did in 1891 and 1892, the maximum productive power of the retort-house would be reached in three years; that the coke yard was, he feared, very much less than would be required during the coming winter; and that the purifying power was much in want of room. The suggestion was made by one of the members that they might consider the subject of the removal of the works to another site; but the question was apparently too large for the Commissioners, and nothing came of it. There is time yet to consider it; but in a year or two something will in all probability require to be done, as the works are very crowded and inconveniently situated.

I can quite understand the interest which is taken in Glasgow upon oil-gas enriching; but I am puzzled to know who the genius is that is inspiring descriptive articles to the newspapers upon the subject. A fortnight ago I directed attention to an extraordinary article in the *Citizen*. On Tuesday of this week there was another, much more sensible, but still peculiar, in the *Glasgow Herald*. The writer starts with the statement that the Lowe process has proved practically successful; and then goes on to say that there are other systems, and that the Corporation have resolved on laying down a Peebles plant to test it. He then names the towns where water-gas, oil gas, and the Peebles process are at work. Then follows an essay upon the effect of oil-gas making upon the cannel trade; and after that a narration of the amount of Lowe gas which is being made in the different places where it has been adopted in Europe—the total running up to 18,700,000 cubic feet per annum [should be per day], requiring 32 million gallons of oil. The figures for the Peebles process, it is stated, cannot be given. It is then concluded that, to supply the wants of Glasgow alone in the matter of oil for gas making, when it comes into general use, would absorb the whole make of burning oil of one of the largest Scotch companies. There is nothing in the tone of the article to which exception can be taken; it is, in fact, antagonistic to neither process. But what I cannot understand is why the two processes should be so mixed up together. An ordinary reader can hardly be expected to follow the labyrinth. To the article a gas manager wrote, in reply, that he calculated that the quantity of oil used would displace 1870 tons of gas or cannel coal per day, or 682,550 tons per annum; and he added that, whoever used oil for gas-making once would never use shale or cannel again, as out of every ton of shale there was about 14 cwt. of rubbish to dispose of, all of which could be handled more profitably at the oil-works. These are interesting conclusions to arrive at; and they give some idea of the great change which the adoption of oil processes is making in the gas industry. All this is reassuring; but opinions differ, as a letter in the *Glasgow Herald* to-day, over the initials J. K., illustrates. This writer says: "The whole output of shale in Scotland for oil making is only 2 million tons; and the quantity of crude oil from this will amount to about 50 million gallons. But when you take 45 per cent. for burning oil, 20 per cent. for heavy lubricating oil, 12 per cent. for paraffin scale, and 4 per cent. for tar and coke, there is only 19 per cent. of oil available for gas making, or about 10 million gallons—one-fourth of the requirements of present make, according to your article. You also state that Glasgow, with only an experiment plant, makes 350,000 cubic feet of oil gas, requiring about 850,000 gallons. I would ask what quantity will they use if successful, and they put up permanent plant extensively at their various works—viz., Dalmarnock, Tradeston, Temple, and Dawsholm. Suppose the other large towns follow their example, the effect of this extra demand will assuredly be such an advance in price as will send the gas corporations back to the coal, so long as they sell at prices similar to those ruling during the last two years. Whenever oil is used to the extent indicated in your article, prices are sure to react against it; and therefore gas companies will require to be cautious." To this, the Editor adds the following remark: Our correspondent is evidently not aware that what is known as "burning oil" is also used for gas-making purposes (through enriching coal); and if Scotch oil were run up in price, American and Russian are available. All English and Continental gas-works use one of these oils. There are apparently about to be interesting times over oil gas.

I observe that Mr. W. Kennedy, the Managing-Director of the Broxburn Oil Company, at the annual meeting of the Company this week, referred to the supply of crude oil to gas-works as another outlet for their products; but he added that they could not make oil for that purpose alone. The Company are having their retorts converted into the Young and Beilby pattern; and Mr. Kennedy stated that, when this was completed, they expected to increase their make of sulphate of ammonia from 22 to 30 tons per day. The Chairman of the Oakbank Oil Company also referred to the subject of oil gas, in nearly the same terms as I wrote last week; and he gave the information that the production in Scotland of the class of oil required for gas-enriching purposes would be sufficient to supply all the Scotch gas corporations and companies.

The Falkirk Town Council have had their first field-night over the costs of their parliamentary contest. Objection was taken to the payment of a large account incurred by Mr. Storey, who has piloted the Corporation Gas Bill so far; and that led to personalities between him and Bailie Rennie. According to Bailie Rennie, there was no occasion for incurring the expenditure, as the Gas Company would have agreed, without going to London, to an open arbitration; and therefore the money spent in London had been wasted. Mr. Storey's reply was very personal, and is only worth noticing because of his reiterating that the Town Council had had a complete victory. Nothing more absurd could be said, because the Bill has yet to pass one branch of the Legislature, and after that the arbitration has to take place which will fix how much the Corporation are to pay for the Gas Company's undertaking. Until all that is passed, it is premature for Mr. Storey to crow. Besides, unless Mr. Storey wishes that the Arbitrator should give an unfairly low price for the gas undertaking, he ought not to speak of, or to contemplate, victory, because the Arbitrator, if acting under a private arrangement, would have given exactly the same award as he is likely to do now when he sits under a parliamentary agreement. Therefore there can be no victory on either side, unless, indeed, it be, as I have already said, that the Gas Company have so far secured an advantage in getting an open arbitration against the wishes of the Corporation.

Glasgow possesses a pile of municipal buildings which cost half a million, and of which the citizens are, very properly, proud. They must have received a shock, when it was announced this week that, in a certain room in the building, it has been discovered that the woodwork near an electric wire is charred, and not only charred but has actually been on fire. The building must, at some time, have narrowly escaped being destroyed by fire. And yet electricians tell us that, with proper fittings, there is no risk of fire being caused by electricity. The fittings in such a handsome and valuable building can scarcely be otherwise than of the best; but I suppose they will get the blame, or perhaps the engineer will.

North Berwick is a very small place, with a considerable reputation as a summer resort. The Corporation recently took over the local gas undertaking; and they are now proceeding to re-arrange their public departments, with a view to economy. This, of course, is very commendable; and the only question there can be is whether the re-arrangement be a sensible one. The Town Council have resolved to amalgamate the offices of Gas Manager, Water Manager, Inspector of Cleaning, and Sanitary Inspector; and they have further agreed that Mr. James Black, the Gas Manager, be offered the situation, with the consequence that, if he does not accept it, they will advertise for candidates. I must say that, when the size of the town is taken into account, I see nothing out of place in the arrangement. In most places of the size of North Berwick, the Gas Manager gives a hand in the works; and if the extra duties of the combined offices were to require Mr. Black to devote his whole time to superintendence, his status would be improved. If, however, he were still to be regarded as a working hand, the arrangement would not be commendable.

The Aberdeen Corporation seem to be very generously disposed towards their employees in the gas-works. This week the Gas Committee agreed to a request by the workmen that their weekly twelve-hour shift should be taken on Saturday instead of on Sunday; that the workmen should have a six days' holiday every year instead of four; and that all the employees who had not received an advance of wages since 1885 should get an increase of ½d. per hour.

With regard to the low yield of gas obtained in the Lockerbie Gas-Works, I am now able to give the reply of the Manager (Mr. Patrick O'Neill) to the remarks of the former writer. Writing in the columns of the same newspaper, Mr. O'Neill says that a little knowledge is a dangerous thing; and that he regrets the former correspondent did not endeavour to obtain information from official sources before rushing into print. The figures given, he says, apply to a period which ended fifteen months ago; and since then very extensive improvements have been made on the works, which have placed them on as sound a footing as in any of the towns named, for obtaining the maximum yield of gas from the coal. According to Mr. O'Neill, the report for the year ending on the 15th inst. will be issued in a few days, when the result of the improvements will be shown. Well, I am glad to be assured that such is the case; but, taking my information from another writer in the same columns, that in the towns with which the comparison was made steam-exhausters are used, by means of which the yield of gas is increased by from 1500 to 2000 cubic feet per ton, I feel bound to say that I very much doubt whether Mr. O'Neill's "maximum yield" will be obtained. There are other two matters which ought to be pointed out. The one is Mr. O'Neill's statement that the figures in the Parliamentary Return apply to a period which ended fifteen months ago. Mr. O'Neill's letter appeared on the 11th inst.; and the Parliamentary Returns are given as for the year ending May 15, 1893. The second matter is a statement by the other writer that, of the total quantity of coal given in the return, a portion was used for household purposes, some for preventing the holders from freezing, and some as fuel for heating the retorts. Now the Parliamentary Returns are intended to state the number of tons of coal carbonized, and not the amount used. Do the figures in the returns not apply to the period named, and are they not accurate?

New Water-Works in Kent.—Last Thursday week, in the presence of a large assemblage of people, the new water-works which the Rye (Kent) Corporation have had constructed were formally opened by the Mayoress.

CURRENT SALES OF GAS PRODUCTS.

LONDON, *May* 19.

Tar Products.—The improvement in pitch continues; and judging from the large number of inquiries, the general impression with regard to this market is not in the direction of falling prices. The consumption appears to be heavy; and the production seems undoubtedly to be less. Benzols have no appearance of improvement. There is no anxiety on the part of buyers to cover; and last week's prices are about those now obtainable. Carbolic is believed to be firmer, but has not so far exhibited the activity expected with the advance of the summer season. There is no change to be reported in anthracene. To-day's values are: Tar, 12s. to 16s. Pitch, 27s. to 28s. Benzol, 90's, 1s. 1d.; 50's, 1s. 4d. Solvent naphtha, 1s. 2d. Creosote, 1¼d. Creosote salts, 25s. Toluol, 1s. 8d. Cresylic acid, 1s. 1d. Crude benzol naphtha, 30 per cent., 5½d. Carbolic acid, 60's, 1s. 8d. Anthracene "A," 1s. 1d.; "B," 10½d.

Sulphate of Ammonia is rapidly recovering from the depression of a few weeks ago; and, within the last few days, it has jumped several shillings a ton. For early delivery, £13 12s. 6d., less 3½ per cent., has been done; but much higher prices are spoken of for forward. Gas liquor is offered at 9s. 6d. to 11s. 6d. per ton.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—With collieries throughout the Manchester district closed during the whole of last week, and with more or less extended stoppages of pits in other districts, there is very little just at present to report with regard to the coal trade of Lancashire. So far as there has been any business doing, prices remain fairly steady, as regards those quoted by the leading Manchester colliery firms and the list rates of the Lancashire Coal Sales Association; but some of the collieries outside the Association are cutting in at under the official rates. Surplus supplies of coal from other districts also continue to be pushed here at very low figures, which gives a weak and irregular tone to the market, and renders it very difficult for Lancashire colliery owners to maintain their present official list rates, in some of the outside markets. At the pit mouth, quotations may be given about as follows: Best Wigan Arley, 11s. to 11s. 6d., with special quotations at 12s.; Pemberton four-feet and seconds Arley, 10s. to 10s. 6d.; and common round coals, according to quality, from 7s. 6d. up to 8s. 6d. per ton. The shipping demand for steam coal continues very unsatisfactory; but notwithstanding many suggestions that there should be a further reduction in list rates by the Lancashire Coal Sales Association, 8s. 6d. is still the average figure for Lancashire steam coal delivered at the ports on the Mersey. Engine fuel moves off fairly well at late rates; slack ranging from 5s. for common, up to 6s. and 6s. 6d. for the best qualities. Through-and-through coal, which is now being largely used for engine purposes, can, however, be readily bought at 6s. 9d. to 7s. 3d. per ton. There is still a very uneasy feeling with regard to the wages question; and I believe that at a recent meeting of Lancashire coalowners, there was an almost unanimous feeling to take action in the matter, which was only prevented by the fact that support from other districts was wanting. Whether any definite move will be made later on in the summer for reducing wages, is an open question; but there seems to be a decided want of unanimity, and one or two of the leading Lancashire colliery proprietors have recently been backing out of their connection not only with the Coal Sales Association, but also, I believe, with the Coalowners' Federation.

Northern Coal Trade.—There has been rather more animation in the North-eastern coal trade during the last few days, stocks having fallen during the holidays. The collieries have worked more fully, and the shipments have increased, so that trade has on the whole been better; but it is not expected that there will be a long continuance, because the output is so large. The demand for steam coals is a steady one. Prices are still quoted at 10s. for best Northumbrian steam coals; second qualities vary from 9s. to 9s. 3d.; and steam smalls are about 4s. 6d. per ton f.o.b. Manufacturing coals are steady, without alteration in price. In gas coals, there is considerable dulness just now; the inland consumption being about at its lowest ebb, though one or two collieries are shipping rather heavy quantities under contract. Prices of Durham gas coals vary from 7s. to 7s. 6d. per ton f.o.b.; and in a week or two it is expected that there will be increased deliveries, to complete contracts that will expire with the half year. Smithy coal is firm in price; and the demand from abroad is steady. In coke, there is a slight recovery in the demand for export; and the home consumption at the blast furnaces is rather larger. Prices generally vary from 13s. up to 14s. per ton f.o.b., though up to 15s. per ton is asked by one or two firms. Gas coke is now in rather limited production, and the price is well maintained; the stocks in the hands of the chief local gas companies being naturally small at this season of the year.

Scotch Coal Trade.—The coalmasters in Lanarkshire and Fifeshire have declined to meet their men on the subject of the reduction of wages. This decision has not led to the cessation of work which was to be expected, as the men are helpless. The four days' idleness of last week enabled coalowners to clear out some of their accumulations. There has been inquiry from America for coal; but nothing has as yet been done in that direction. Otherwise the market is very dull. Any demand there is, is for immediate delivery; foreign purchasers being inclined to hold back in the expectation of getting easier prices, and home consumers being also working mostly from hand to mouth. The prices quoted are: Main, 7s.; ell, 8s. to 8s. 6d.; splint, 7s. 9d. to 8s.; and steam, 9s. to 9s. 3d. per ton f.o.b. Glasgow. Shipments for the week amounted to 128,273 tons—a decrease as compared with the previous week of 48,399 tons, and as compared with the corresponding week of last year of 10,233 tons. For the year to date, the total shipments have been 2,582,329 tons—an increase over the quantity in the corresponding period of last year of 336,041 tons.

The Price of Gas in South London.—Mr. James Rowlands, M.P., President of the Gas Consumers' Protection League, having written to Mr. George Livesey, asking whether it was correct that the Company intended to reduce the price of gas from 2s. 5d. to 2s. 4d. per 1000 cubic feet, has received the following reply: "It is, and has been for many years, our policy and our practice to make as accurate an estimate as possible of our probable profits in the ensuing twelve months; and if they are sufficient to warrant a reduction, to make it at once. We have once or twice cut the thing rather too fine; and on the present occasion there are some elements of doubt in connection with the coal and residual markets. But the Directors, in their anxiety to do their best for the consumers, and indirectly for their shareholders, decided to take the risk."

Newcastle and Gateshead Water Company's Bill.—A verbal report on the subject of the Local Water Company's Bill was made by Alderman Hamond, M.P., at last Thursday's meeting of the Newcastle City Council. In the course of his remarks, he stated that the Company had inserted a clause which was most unusual, and which contained statutory obligations. For the first time they had in a Water Company's Bill statutory power compelling them to construct and finish a reservoir in seven years. But in another section there was a provision exactly contrary in effect to that one. If the works authorized by the Act were not completed within the time specified, the Company might abandon them; and the obligation would have no effect. The clause might have been dropped in inadvertently; but he need scarcely point out the absurdity of compelling the Company to make and complete a reservoir in seven years, and then to say that they need not do it unless they liked, if it was not finished in the seven years. The Corporation had acted in good faith towards the Company; but at the same time, it was their bounden duty to secure a full and ample supply of pure water. Therefore he asked the Council—not in any antagonistic spirit—to allow them to have a *locus standi* in the matter of the Bill now going before the House of Commons, to enable them to petition against it so as to have the clause erased. Another important matter to which Alderman Hamond referred was the great opposition the Council had to encounter from the Duke of Northumberland, or his agent. They actually had the assurance, he said, to ask the Committee of the House of Lords that the Company should be compelled to supply to his Grace a million gallons of water per day; and he had reason to believe they were also going to ask that in the Commons. The Council agreed to the signing of a petition against the Bill.

Exhibitions of Gas Appliances.—A highly interesting exhibition of gas-stoves and general lighting appliances has just been held at the Mechanics' Institution, Stockport, under the auspices of the Corporation Gas Department. Messrs. Richmond and Co., Limited, Messrs. Fletcher, Russell, and Co., Limited, and Messrs. R. and A. Main showed a large, varied, and interesting collection of their model gas cookers, fires, and other apparatus. In the lighting section, Messrs. G. Bray and Co., the Incandescent Gas-Light Company, the Deimel Light Company, and Messrs. Stott had a brilliant display of apparatus; while Messrs. Andrew and Co. exhibited their well-known new "Otto" type gas-engine. Messrs. Sawer and Purves had a fine collection of dry and wet meters, prepayment meters, and general brass goods. A novel feature in connection with the exhibition was the display of specially prepared lantern slides, illustrating the humours of coal *versus* gas, which proved highly attractive. Miss Owen's instructive lectures on cookery twice daily were followed with interest by a large audience. The exhibition was opened on the 30th ult. by the Mayor (Mr. J. Turner), and was closed on the 5th inst., having fully realized the expectations of the Gas Committee.——An exhibition of gas heating and cooking appliances was held from Tuesday to Friday last week, in St. Mary's Hall, Dumfries, by Messrs. R. and A. Main, under the auspices of the Corporation Gas Department. Miss Burden gave cookery lectures and demonstrations.——The exhibition of gas appliances which the Davis Gas-Stove Company, Limited, opened, with Mrs. Hunter as lecturer, in the Albert Hall, Portsmouth, on the 1st inst., as already notified in our columns, was so successful that they determined on extending it beyond the fortnight originally proposed. The exhibition closed last Saturday.

A Question as to a Right to Water.—In the Chancery Division of the High Court of Justice, Mr. Justice Romer recently had before him the case of *The Brymbo Water Company v. Lester's Lime Company, Limited*, the nature of which will be gathered from the following outline: The plaintiffs were incorporated by a Private Act of Parliament in 1869, under which they supply Brymbo and adjacent places with water The defendant—a lady named Morris—is the lessee of certain lime-works at Minera, near Wrexham. The case for the plaintiffs was that, under the Act of 1869, they obtained power to dam up a brook called Nantyffrith, and the right to the waters flowing into it; among other streams being one known as Abergroes, which was partly artificial and partly natural. The defendant derived the supply of water for her works from a small pool, the level of which was below that of the Abergroes. During the months of April, May, June, and the early part of July last year, this pool became almost dry; and the defendant constructed a dam across the Abergroes, the effect of which was to cause some of the water to flow into the pool. By reason of this, the plaintiffs alleged that the water in their reservoir had been so reduced that they had been obliged to limit the supply to their customers, and had suffered damage in consequence. They accordingly claimed an injunction to restrain the defendant from interfering with the flow of water along the Abergroes stream from its source at Llyn Eddy down to the Nantyffrith reservoir, from taking any of the waters of the stream, and from cutting or interfering with the banks thereof. They also asked for damages. The defence was that the defendant had had the use of the brook from time immemorial; and she counterclaimed for damages and an injunction. His Lordship, in giving his reserved judgment, said he had no hesitation in coming to the conclusion that the plaintiffs had failed in sustaining their claim to the water the defendant was taking, and their alleged right to pull down or interfere with the dam. He dismissed the action with costs; and on the counterclaim, he granted an injunction substantially in accordance with the first claim, and gave the defendant her costs.

Additional Capital for the West Ham Gas Company.—Our readers will see, by an announcement which appears in our advertisement columns, that Mr. Alfred Richards has been instructed by the Directors of the West Ham Gas Company to offer for sale by auction, at the Mart, next Thursday, £10,700 of the Company's perpetual 4 per cent. debenture stock, and 800 shares of £10 each. The standard rate of interest on these shares is 7 per cent., subject to the sliding-scale; and the last dividend was one of 5½ per cent. per annum.

The Position of Electric Lighting at Hull.—A proposal was made by the Electric Light Committee, at the last monthly meeting of the Hull Town Council, that the charge for electricity should be reduced from 7d. to 6½d. per unit. From remarks made by the Chairman (Dr. Holder), it appeared that the Committee commenced the past financial year by supplying 3790 8-candle power lamps, and ended it with 9400 lamps connected. The present cost of production was 6¾d. per unit; but the increased consumption which ought to follow the reduction would, he thought, turn a trifling loss into a profit. The proposition was adopted.

The Testing of Gas-Meters in Manchester.—At a meeting of the Manchester City Justices last Thursday week, the Official Inspector of Gas-Meters (Mr. S. Dyson) presented his report for the year ending March 31. The number of meters tested was stated to have been 12,628—an increase of 968 as compared with the previous year. The fees received amounted to £474 17s. 4d., as against £386 9s. There was a debit balance of £316 16s. 2d., of which £145 2s. 3d. was due to expenditure on new plant. Of the total number of meters tested, 425 (3·36 per cent.) were rejected. The total number tested since the office was instituted in 1862 was 306,697; and the fees amounted to £9910 6s. 10d. The total amount of loss was £8852 13s. 5d. This, Mr. Dyson stated, arose from the scale of fees under the Gas Act of 1859 being too low. The Committee had had under consideration the "penny-in-the-slot" gas-meters, and also the dry form of gas-meters. With regard to certain types of the former, there was considerable doubt as to whether the insertion of a penny would secure the passage of an equivalent value in gas. There was also a great amount of unreliability about dry gas-meters. The Committee had decided to approach the Board of Trade to obtain amended regulations, conforming with modern requirements. The report was approved.

The Condition of the Penrith Water Supply.—Dr. Bruce Low, one of the Medical Inspectors of the Local Government Board, who has been inquiring into the condition of the River Eamont, from which Penrith derives its water supply, has issued his report. He gives specific instances of alarming pollution, and states that the present supply of the town must be regarded as open to serious risk of contamination. The Penrith Local Board, he states, have called to their assistance Mr. G. F. Deacon, who, after a long and careful examination of the locality, submitted two schemes: (1) To continue to take water from the Eamont, but to remove the intake to the higher reaches of the river, and to provide means for the filtration of the river water. This is known as the filtration scheme. (2) To collect water from various streams and springs in the vicinity of Melmerby Fell, and to convey it to Penrith by gravitation. This is known as the gravitation scheme. The first of these schemes was estimated to cost £13,088; and the other, £15,914. For many months public opinion in Penrith has been divided upon the merits of these respective schemes; and the Sanitary Authority has again and again discussed them, but without coming to a definite decision as to adopting the one or the other. The majority of the members appear to be in favour of patching up the present defective system, by repairing the service tanks and mains so as to prevent waste, and by laying iron pipes in place of the present earthenware ones, between the intake and the pumping-station at Eamont Bridge. In conclusion, Dr. Bruce Low says that, in his view, the town is, under existing conditions, at all times liable to be attacked by epidemic disease such as can be conveyed by water; and the sooner the Sanitary Authority can be brought to recognize this fact, the better it will be for the inhabitants. This report has been under the consideration of the Local Board; and they have decided to await the reply of the Local Government Board to their application for power to borrow only £3500 for improving the present water system.

The Alleged Irregularities at the Southport Corporation Gas-Works.—The public inquiry into the alleged irregularities in the management of the Southport Corporation gas estate was commenced last Thursday evening at a special meeting of the Council, sitting as the General Purposes Committee. This week we cannot do more than give an indication of what transpired; but a longer account will appear in our next issue. The Mayor (Alderman Wood, M.D.) opened the proceedings by making a comprehensive statement as to the steps which had been taken in this matter. Dealing first with the irregularities in which the Gas Manager (Mr. J. Booth) had been concerned, he clearly showed that these merely had reference to the manner in which he had kept his books, and plainly acquitted him of all fraud. The next and most serious matter was in connection with the Eastbank Street office, where the receipt-books showed some "grave irregularities;" but the sums missing did not amount to much. The receipt-books, it seemed, were not paged, the perforations were imperfect, and they were badly bound; so that leaves could be extracted without any mark whatever—indeed, there was plenty of indication that a large number of leaves had been cut out of the books. But if, said the Mayor, they made the utmost allowance for all these matters, the total amount of all the fraud could only be very small indeed—not more than £50—and not at all worthy of the trouble and talk that there had been about it. Mr. William Booth, the son of the Gas Manager, he intimated, had been dismissed, and a competent clerk installed in his place. Having done what they could to safeguard the property of the ratepayers, the Mayor said the Committee tried to ascertain whether any fraud had taken place with regard to coal and cannel; and the Council would be surprised to hear that they found there was a surplus—not a deficit—of 3888 tons, and the accounts disclosed a production of above 9000 cubic feet of gas per ton. Following the Mayor's statement, there was a prolonged and heated discussion; but after a sitting of four hours, a resolution was passed adjourning the inquiry until some member of the Council had a distinct allegation to make, and had witnesses to call to substantiate it.

Holywood Gas Company, Limited.—The report of the Directors of this Company for the year ending the 1st inst. states that the profit on the working of the undertaking for this period was £706. With £124 brought forward, there is £830 for disposal. A dividend at the rate of 5 per cent. per annum is recommended, which will absorb £540; and the Directors advise the placing of £200 to the credit of the reserve fund—leaving £90 to be carried forward.

Congress of the Gas Workers' Union.—The fourth congress of the Gas Workers' and General Labourers' Union was held in Leeds from Monday to Friday last week, under the presidency of Mr. Pete Curran. The proceedings were conducted in private. The General Secretary (Mr. W. Thorne) read the report, which stated that, though the year had been a very trying one for all Trades Unions, the London branch alone had increased their balance at the bank from £3076 to £4466—a net gain of £1390. The banking accounts of all the districts had been increased from £4643 to £6217, or a gain of £1574. The total membership was now 36,000. Returns were submitted from the Plymouth, Bristol, Mersey, Sunderland, Sheffield, Belfast, and Manchester branches, and were considered to be of a thoroughly favourable character. They showed the Union to be growing both numerically and financially in all parts of the country. The next congress is to be held in Bristol in 1896.

The Price of Gas in the Chartered Company's Districts.—Last Thursday evening, a public meeting, convened by the four Ratepayers' Associations in St. Pancras, was held in the Vestry Hall, to protest against the price charged by The Gaslight and Coke Company in their district north of the Thames, as compared with their south-side district. Mr. A. Boden occupied the chair. The speeches were of much the same character as those delivered at similar meetings lately held in various parts of North London, as noticed in our columns. Emphasis was laid on the fact that the South Metropolitan Gas Company had decided to reduce their price by 1d. per 1000 cubic feet as from Lady-day last; and the consumers north of the Thames were urged to keep up their agitation for some concession by The Gaslight and Coke Company—in fact, for a reduction to the level of the price charged by them over the water. Resolutions embodying the views of the meeting were unanimously passed.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 959.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	12 Apl.	10½	Alliance & Dublin 10 p. c.	10	17½—18½	..	5 13 6
100,000	10	,,	7½	Do. 7 p. c	10	12—13	..	5 15 4
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	107—109	..	4 11 9
100,000	20	14 Dec.	8	Bahia, Limited	20	10—11	..	14 10 10
200,000	5	11 May	6½	Bombay, Limited	5	5—5⅛*	..	5 18 2
40,000	5	,,	6½	Do. New	4	4—4⅛*	..	5 15 6
980,000	Stck.	28 Feb.	11½	Brentford Consolidated	100	217—222	..	5 3 7
180,000	,,	,,	8½	Do. New	100	167—172	..	4 18 10
220,000	Stck.	15 Mar.	11½	Brighton & Hove Original	100	210—215	..	5 6 11
888,500	Stck.	28 Feb.	5	Bristol	100	109—112	+2	4 9 3
320,000	20	29 Mar.	11½	British	20	45—47	..	4 15 10
50,000	10	28 Feb.	11½	Bromley, Ordinary 10 p. c.	10	21—22	..	5 4 7
51,510	10	,,	8½	Do. 7 p. c.	10	16—17	+½	5 0 0
328,750	10	28 July	2	Buenos Ayres (New) Limited	10	5½—6½	..	3 1 6
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	101—104	..	5 15 5
150,000	20	28 Feb.	8	Cagliari, Limited	20	26—27	..	5 18 6
550,000	Stck.	12 Apl.	12½	Commercial, Old Stock	100	252—257	..	4 17 3
165,000	,,	,,	9½	Do. New do.	100	190—195	..	4 17 5
160,762	,,	14 Dec.	4½	Do. 4½ p. c. Deb. do.	100	132—137	..	3 5 8
800,000	Stck.	14 Dec.	13	Continental Union, Limited	100	235—240	+1	5 8 4
200,000	,,	,,	10	Do. 7 p. c. Pref	100	205—210	..	4 15 3
535,000	Stck.	28 Feb.	5	Crystal Palace Ord. 5 p.c. Stk	100	105—110	..	4 10 11
486,090	10	31 Jan.	10	European, Limited	10	22—23	..	4 6 11
354,060	10	,,	10	Do. Partly paid	7½	15½—16½	..	4 10 11
5,646,590	Stck.	14 Feb.	12	Gaslight & Coke, A, Ordinary	100	225—230	−2	5 4 4
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	100—104	+2	3 16 11
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	273—278	..	3 12 0
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	130—135	..	3 14 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	190—195	..	3 16 11
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	175—180	..	3 17 9
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	272—277	..	3 12 3
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	165—170	..	3 10 7
1,061,150	,,	14 Dec.	4	Do. 4 p. c. Deb. Stk.	100	128—131	+1	3 1 0
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	132—137	..	3 5 8
908,000	,,	,,	6	Do. 6 p. c. do	100	177—182	..	3 5 11
3,800,000	Stck.	11 May	12	Imperial Continental	100	215—220*	+2	5 9 1
75,000	5	14 Dec.	6	Malta & Mediterranean, Ltd.	5	4½—5	..	6 0 0
560,000	100	2 Apl.	5	Met. of Melbourne, 5p. c. Deb.	100	109—111	..	4 10 1
541,920	20	15 Nov.	5	Monte Video, Limited	20	13¼—14¾	..	6 18 0
150,000	5	30 Nov.	8	Oriental, Limited	5	5⅞—6⅛	..	6 8 0
60,000	5	29 Mar.	7	Ottoman, Limited	5	3¾—4¼	..	7 7 4
166,870	10	31 Jan.	2	Pará Limited	10	1⅞—2¼	−½	8 17 9
420,000	100	2 May	6	People's Gas of Chicago— 1st Mtg. Bds.	100	102—107	..	5 12 1
500,000	100	1 Dec.	6	2nd Do.	100	97—102	..	5 17 8
150,000	10	26 Apl.	6	San Paulo, Limited	10	9½—10⅜	..	5 14 3
500,000	Stck.	28 Feb.	15½	South Metropolitan, A Stock	100	315—320	..	4 16 11
1,350,000	,,	,,	13	Do. B do.	100	258—263	+5	4 11 3
260,000	,,	,,	13	Do. C do.	100	262—267	..	4 17 4
750,000	,,	17 Jan.	5	Do. 5 p. c. Deb. Stk.	100	153—157	..	3 3 8
60,000	Stck.	28 Feb.	11½	Tottenham & Edm'nton, "A"	100	210—215	..	5 7 0
				WATER COMPANIES.				
745,967	Stck.	29 Dec.	10	Chelsea, Ordinary	100	277—282	+2	3 10 11
1,720,252	Stck.	12 Apl.	8	East London, Ordinary	100	225—230	+2	3 9 7
544,440	,,	29 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	147—150	..	3 0 0
700,000	50	14 Dec.	8½	Grand Junction	50	115—119	+1	3 11 5
708,000	Stck.	28 Feb.	11½	Kent	100	290—295	..	3 17 11
1,043,800	100	29 Dec.	9½	Lambeth, 10 p. c. max.	100	255—260	..	3 13 1
406,200	100	,,	7½	Do. 7½ p. c. max.	100	203—207	..	3 12 5
310,000	Stck.	29 Mar.	4	Do. 4 p. c. Deb. Stk.	100	132—135	..	2 19 3
500,000	100	14 Feb.	12½	New River, New Shares	100	367—372	..	3 5 2
1,000,000	Stck.	31 Jan.	4	Do. 4 p. c. Deb. Stk	100	133—136	..	2 18 10
902,300	Stck.	14 Dec.	6	S'thwk & V'xhall, 10 p. c. max.	100	161—164	..	3 12 2
126,500	100	,,	6	Do. D 7½ p. c. do.	100	147—152	..	3 19 0
1,755,066	Stck.	14 Dec.	10	West Middlesex	100	271—276	+3	3 12 6

*Ex div.

The Driffield Local Board and the Gas-Works.—With reference to the inquiry which the Driffield Local Board addressed to the Local Government Board, as to whether it was necessary for them to obtain a Provisional Order to authorize the purchase of the gas-works having regard to section 162 of the Public Health Act, 1875, the latter body have replied "that although a Provisional Order is not required to empower the Great Driffield Local Board to purchase the undertaking of the Driffield Gaslight Company, such an Order would be necessary to enable them to carry it on after the purchase has been effected. Without such a Provisional Order, the Local Board would have none of the powers which are given by the general statutes for the carrying on of gas undertakings."

Malta and Mediterranean Gas Company, Limited.—The operations of this Company during the year ending March 31 last have been generally satisfactory; and notwithstanding a small decrease in the gas-rental, owing to depression of trade, the revenue from all sources has been fairly maintained. From the balance at disposal, the Directors recommend, after the payment of the usual dividends upon the first and second preference capital, a dividend of 4 per cent. upon the ordinary capital; making, with the interim payment of 2 per cent., 6 per cent. for the year, and leaving £1384 to be carried forward. The accounts show that the income of the twelve months (including an item "late Manager's life policy, £615") amounted to £35,613. Subtracting from this the expenditure, there remains £11,166 as the profit on the year's transactions.

Sale of Shares in the Hexham Gas Company.—A large sale of shares in the Hexham Gas Company took place a few days since. There were 102 original £10 (10 per cent.) shares; and 50 "B" shares of the same nominal value, but bearing only 7 per cent. dividend. The former were knocked down at the following prices per share: 10 at £22 5s., 35 at £22 2s. 6d., and 57 at £22—a total of £2250 17s. 6d. The "B" shares were all sold at the same price—viz., £14 2s. 6d. each; and they realized a sum of £706 5s.

The Past Year's Working of the Widnes Gas and Water Departments.—In the JOURNAL last week (p. 924), we gave the amounts of net profit realized by the working of the gas and water undertakings of the Widnes Corporation in the past financial year as £1149 and £601 respectively. It may be mentioned, in connection with these figures, that they were arrived at after paying for coal £1600 extra for the gas, and £500 extra for the water works, owing to the coal strike. At the meeting of the Town Council at which the foregoing figures were reported, the Chairman of the Gas and Water Committee (Alderman Timmis) explained that the Committee estimated that they had lost, by the stoppage of the large manufacturing works throughout the district, a profit of about £1200; and therefore he considered that the Corporation were to be congratulated upon having come through the crisis with such satisfactory results. He thought it proved that the Committee had adopted a very good policy in trying to encourage the sale of gas and water by the low rates they had charged.

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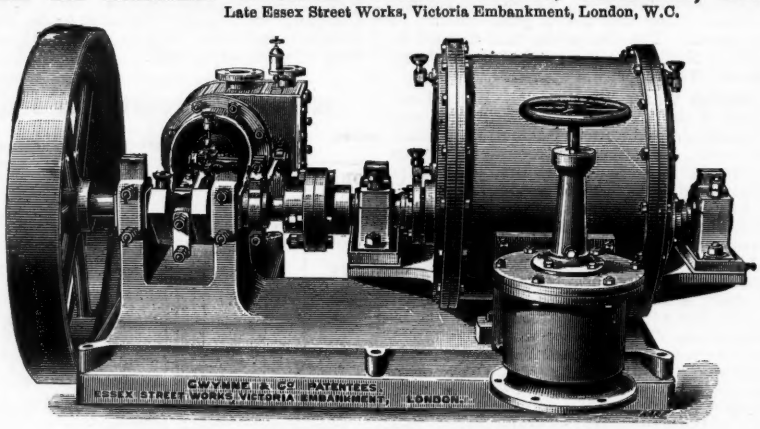

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Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. II., centre of JOURNAL.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock Oldham."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, Leeds, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE & CO., direct Importers from Ireland. Sample and Price on application.
OXIDE PAINT, SULPHURIC ACID, & Chemicals.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE LONDON."

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore. Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

ALWAYS a Buyer of Spent Oxide, Tar, and AMMONIACAL LIQUOR.
Apply to J. HARDMAN, Milton, STAFFORDSHIRE.

SPECIAL PAINT FOR GAS-WORKS.

JOHN E. WILLIAMS AND CO., VICTORIA PAINT WORKS, MANCHESTER.
Telegrams: "ENAMEL." National Telephone 1739.
GAS PLANT CEMENT FOR ALL LEAKAGES.

GOLD MEDAL, 1892.

TUBES and Fittings for Gas, Steam, and Water, in stock to 8 inches diameter; Iron and Steel Ascension-Pipes.
JOHN SPENCER, Globe Tube Works, WEDNESBURY; and 14, Great St. Thomas Apostle, LONDON.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

CHARTERING, FORWARDING, AND INSURANCE.

ROBERT BRUCE FITZMAURICE, 29, Great St. Helens, London, Shipping Agent to several Gas Companies and Plant Manufacturers, would be glad to UNDERTAKE LARGE or SMALL SHIPMENTS to any Port.

HUTCHINSON BROTHERS, Gas Engineers, &c., Falcon Works, Barnsley, Makers of Wet and Dry Gas-Meters, Brass-Work, and general Gas Apparatus, Lead Saturators, Tanks, &c., Tools, and Gas-Works Sundries. (See last week, p. 930.)
Telegrams: "HUTCHINSON BROS., BARNSLEY."

WANTED, by an experienced Man, age 36 (Brass Finisher and Gas-Fitter), a Situation as WORKING FOREMAN or ASSISTANT FOREMAN to a Gas Company.
Address No. 2388, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

MAN (Young) seeks employment as STOVE-FITTER, METER FIXER, INDEX TAKER, and good MAIN and SERVICE LAYER. Over ten years in last employ.
Address No. 2386, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

AGENCY (additional) wanted by Advertiser having good connection among Gas Engineers in London and Southern England. Good opportunity for placing new Invention before Gas Managers, or for extending already existing Business.
Address, No. 2385, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TAR.

BELGIAN Engineer, having excellent business connections, and able to furnish the highest references, is desirous of undertaking, for a good firm, the Agency for the SALE of TAR in Belgium.
Address No. 2383, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Book-keeper and Chief Clerk in a Water-Works Office, near Manchester. One with a knowledge of Double Entry, and who has been engaged in a Gas or Water Works Office preferred. Wages, 26s. per week.
Applications stating experience, age, married or single, along with copies (only) of three recent testimonials (which will not be returned), to No. 2387, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TOWER Scrubber Wanted (second-hand), having a capacity of 600 or 700 cubic feet.
Price and full Particulars to G. HELPS, HINCKLEY.

WANTED, Four Second-hand Purifiers complete, about 10 feet square.
State Price, with general Dimensions, and whether worked with Centre or Slide Valves, to Mr. JAMES COOK, Town Clerk, ARDROSSAN.

BRIDGEND GAS AND WATER COMPANY.

WANTED a second-hand Tar and Liquor TANK (for underground), in Cast or Wrought Iron. Capacity about 20,000 gallons. Must be in good condition.
Full Particulars, with price (delivered), to
J. H. DYER,
Secretary and Manager.

SECOND-HAND Flange Rails for Sale, in good condition. About 150 tons; quantities to suit purchasers.
Address BALE AND CO., 120-1, NEWGATE STREET, E.C.

PURIFIERS.

FOR SALE—Three 6 feet square Purifiers, complete with Lifting Arrangement, 6-inch Valves and Connections. Replaced by others of larger capacity. Would sell two.
Apply to F. TURNER, Manager, Gas-Works, CHARD.

RAMSGATE CORPORATION.

FOR SALE—Two Double-Blade Rotary EXHAUSTERS, equal to 25,000 cubic feet per hour. Makers, George Waller and Co. Removed to make way for larger ones.
Further Particulars on application to
WILLIAM A. VALON,
Engineer.

CAMBRIDGE UNIVERSITY AND TOWN GAS-LIGHT COMPANY.

TO TAR DISTILLERS AND OTHERS.

THE Directors of this Company will, at their Meeting on May 31, be prepared to receive TENDERS for the surplus TAR and the whole of the AMMONIACAL LIQUOR produced at these Works, for a period of One Year, from July 1 next ensuing.
Further Particulars may be had from the undersigned.
O. J. WEEKS,
Manager.
Gas Office, Sidney Street, Cambridge,
May 4, 1894.

PATENTS FOR INVENTIONS.

J. C. CHAPMAN, Chartered Patent Agent, Fel. Inst. Ch. Pat. Agents, Mem. Inst. Mech. Engineers, ADVISES IN ALL MATTERS relating to PATENTS FOR INVENTIONS, TRADE MARKS, &c. Handbook gratis on application.
70, CHANCERY LANE, LONDON, W.C.

AMMONIACAL LIQUOR Wanted.
BROTHERTON AND CO., Ammonia Distillers, BIRMINGHAM, LEEDS, and WAKEFIELD.

GAS TAR Wanted.
BROTHERTON AND CO., Tar Distillers, BIRMINGHAM, LEEDS, and WAKEFIELD.

SPENT OXIDE Wanted.
BROTHERTON AND CO., Chemical Manufacturers, BIRMINGHAM, LEEDS, and WAKEFIELD.

BOROUGH OF EAST RETFORD.

THE Gas Committee of the above Corporation invite TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR produced at their Works during the Year ending June, 1895.
Tenders to be sent in to the Chairman of the Gas Committee, endorsed "Tender for Tar," or "Liquor," on or before the 31st inst.
Any further Information may be had from the undersigned.
J. B. FENWICK,
Manager.
Gas and Water Office, Retford,
May 8, 1894.

BOROUGH OF EAST RETFORD.

THE Gas Committee of the above Corporation are prepared to receive TENDERS for the supply of 4000 tons of best screened GAS COAL, to be delivered during the Year ending June, 1895.
Sealed tenders to be sent in to the Chairman of the Gas Committee on or before the 31st inst., endorsed "Tender for Coal."
The Committee do not bind themselves to accept the lowest or any tender.
Any further Particulars may be had from the undersigned.
J. B. FENWICK,
Manager.
Gas and Water Office, Retford,
May 8, 1894.

GLASGOW CORPORATION GAS.

TENDERS FOR METERS.

THE Glasgow Corporation Gas Commissioners invite TENDERS for the supply of such METERS (Dry and Wet) as they may require for Twelve Months from the 1st of June next.
Forms of Tender may be had on application to the Manager at the Gas Office, 45, John Street, Glasgow; and sealed offers, marked "Tender for Meters," to be addressed to, and lodged with, the Subscriber on or before Tuesday, the 29th curt.
The Corporation do not bind themselves to accept the lowest or any offer.
J. D. MARWICK,
Town Clerk.
City Chambers, George Square,
Glasgow, May 10, 1894.

CORPORATION OF MACCLESFIELD.
(GAS DEPARTMENT.)

THE Gas Committee are prepared to receive TENDERS for the work required to be done in the taking down, and re-erection in another part of the Gas-Works of Four PURIFIERS, CENTRE-VALVE, and CONNECTIONS, together with sundry new portions.
Further Particulars and Form of Tender may be obtained on application to the Engineer at the Gas-Works.
Sealed tenders, endorsed "Purifiers," and addressed to the Chairman of the Gas Committee, Town Hall, to be delivered on or before the 26th of May, 1894.

BOROUGH OF MACCLESFIELD.

THE Gas Committee are prepared to receive TENDERS for the supply of the whole or part of 10,000 tons of the best screened GAS COALS and 1500 tons of CANNEL, to be delivered free at Macclesfield, at such times and in such quantities as shall be ordered. Deliveries to commence on the 1st of August, 1894, and to be completed within a Year.
Forms of Tender and Conditions may be had on application to the Engineer, Gas-Works, Macclesfield.
Tenders sealed and endorsed to be sent in not later than Saturday, the 26th day of May, 1894, addressed to the Chairman, Gas Committee, Town Hall, Macclesfield.
The Committee do not pledge themselves to accept the lowest or any tender.
W. FREDK. TAYLOR,
Town Clerk.
May 9, 1894.

BOROUGH OF MACCLESFIELD.

THE Gas Committee are prepared to receive TENDERS for the supply of the undermentioned Materials required during a period of Twelve Months, commencing the 1st of July, 1894.
(1) The best hand-picked BUXTON LIME, delivered fresh at Macclesfield, free from Dirt and Ashes, in such quantities as may be ordered.
(2) Wrought-Iron lap-welded STEAM TUBES and FITTINGS.
(3) Cast-Iron MAINS and IRREGULARS.
Any further Information required can be obtained on application to Mr. Newbigging, Engineer, Gas-Works.
Sealed tenders, properly endorsed, to be addressed to the Chairman, Gas Committee, Town Hall, Macclesfield, and to be sent in not later than Saturday, the 26th of May, 1894.
The Committee do not bind themselves to accept the lowest or any tender.
W. FREDK. TAYLOR,
Town Clerk.
May 9, 1894.

HYDRATED OXIDE OF IRON.

PREPARED from pure Iron
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.
READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

COAL CONTRACT.

THE Directors of the Hexham Gas Company are prepared to receive TENDERS for the supply of about 2400 tons of unscreened GAS COAL, delivered at Hexham Station, as directed, during the Twelve Months ending June 30, 1895.
Tenders, with Analysis of Coal and name of Pit at which it is raised, to be forwarded to the undersigned not later than the 9th of June.
HERBERT LEES,
Secretary and Manager.
Gas-Works, Hexham,
May 16, 1894.

TAMWORTH GASLIGHT AND COKE COMPANY

TENDERS FOR COAL.

THE Directors of the above Company are prepared to receive TENDERS for a supply of 2000 tons of best, well-screened GAS COAL, to be delivered between the 1st of July, 1894, and the 30th of June, 1895, in accordance with the Specification.
Forms of Tender and Specification may be obtained from the undersigned.
Sealed tenders to be sent, addressed to the undersigned, not later than June 2 next, endorsed "Tender for Coal."
The Directors do not bind themselves to accept the lowest or any tender.
WALTER A. SAPEY,
Secretary and Manager.
Gas-Works, Tamworth,
May 9, 1894.

TAMWORTH GASLIGHT AND COKE COMPANY.

TO TAR DISTILLERS, ETC.

THE Directors of the above Company invite TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR produced at their Works for One or Two Years from the 1st of July next.
Coals carbonized: About 2200 tons annually.
Tenders for Liquor to be made either at a fixed price per ton, or on Sliding Scale regulated by the Price of Sulphate.
Sealed tenders, endorsed "Tender for Tar and Liquor," to be sent, addressed to the undersigned, by June 2 next.
Any further Information may be obtained on application.
WALTER A. SAPEY,
Secretary and Manager.
Gas-Works, Tamworth
May 9, 1894.

CORPORATION OF CALCUTTA NEW DRAINAGE WORKS.

TO BOILER MAKERS.

TENDERS are invited for the supply of TWO STEEL STEAM-BOILERS, 28 feet long by 7 feet diameter, for the Drainage Pumping-Station, Palmers Bridge.
The Specification can be seen at the Offices of Messrs. Joseph Quick and Son, M.Inst.C.E., 36, Great George Street, Westminster; and tenders are to be sent direct to the Vice-Chairman of the Corporation, Calcutta, superscribed "Tender for Boilers," by the Mail leaving England on the 8th of June, 1894.
The amount of the tenders to be stated in Rupees as well as in Pounds sterling; the Commissioners engaging to adjudicate on the tenders within one month of their receipt in Calcutta.

CORPORATION OF CALCUTTA WATER-WORKS.

TO IRON PIPE FOUNDERS.

TENDERS are invited for the supply of the following CAST-IRON TURNED AND BORED PIPES:—

No. 1000	. . .	4 inches	Diameter.
„ 6000	. . .	3 „	„
„ 5000	. . .	2 „	„

Drawings, Specification, and Form of Tender can be seen at the Offices of Messrs. Joseph Quick and Son, M.Inst.C.E., 36, Great George Street, Westminster.
Tenders, addressed to the Vice-Chairman of the Corporation of Calcutta, and superscribed "Tender for Pipes," are to be sent direct by the Mail leaving England on Friday, the 1st of June, 1894.
The amount of the tenders to be stated in Rupees as well as in Pounds sterling.
The Commissioners do not bind themselves to accept the lowest or any tender.

CORPORATION OF CALCUTTA.

EXTENSION OF WATER SUPPLY.
TO IRON PIPE FOUNDERS AND MANUFACTURERS OF SLUICE-VALVES.

TENDERS are invited for the supply of a quantity of IRREGULAR CASTINGS, varying from 48 inches to 36 inches diameter; also large SUCTION and DELIVERY AIR VESSELS, together with SLUICE-VALVES of 48 inches, 42 inches, and 30 inches diameter respectively.
Drawings, Specification, and Form of Tender can be seen at the Offices of Messrs. Joseph Quick and Son, M.Inst.C.E., 36, Great George Street, Westminster.
Tenders, addressed to the Vice-Chairman of the Corporation of Calcutta, and superscribed "Tender for Pipes and Sluice-Valves," are to be sent direct by the Mail leaving England on Friday, the 8th of June, 1894.
The amount of the tenders to be stated in Rupees, as well as in pounds sterling.
The Commissioners do not bind themselves to accept the lowest or any tender.

RAMSBOTTOM GAS COMPANY.

TENDERS FOR COAL.

THE Directors are prepared to receive, on or before Monday, the 4th of June, TENDERS for the delivery of COALS required at their Works, during a period of One, Two, or Three Years.

Particulars and Forms of Tender may be obtained on application from the undersigned.

JOS. C. INGHAM,
Manager.

Gas-Works, Ramsbottom.

THE Rastrick Gas Company invite TENDERS for the supply of about 5000 tons of GAS COAL, to be delivered free at their Works, or in Trucks at Brighouse Station, in such quantities, and at such times as may be directed from July next to June 30, 1895.

Tenders, endorsed "Tender for Coal," must be delivered not later than Saturday, June 2.

The Directors do not bind themselves to accept the lowest or any tender.

ALFRED WEST,
Secretary and Manager.

Gas-Works, Rastrick,
May 19, 1894.

PURIFIERS.

THE Directors of the Tynemouth Gas Company are prepared to receive TENDERS for the supply and erection of Two PURIFIERS.

Plans and Specifications may be inspected at the Company's Works, North Shields.

Tenders, endorsed "Tender for Purifiers," to be forwarded to the undersigned not later than Wednesday, June 6.

The Directors do not bind themselves to accept the lowest or any tender.

W. HARDIE, jun.,
Engineer.

Gas-Works, North Shields,
May 19, 1894.

TENDERS FOR COAL.

THE Directors of the Town of Dudley Gaslight Company are prepared to receive TENDERS for the supply of 5000 to 12,000 tons of GAS COAL, to be delivered at the London and North-Western Railway or Great Western Railway Sidings, Dudley, in such quantities as may be required from the 1st of July, 1894, to the 30th of June, 1895.

Sealed tenders, addressed to the Chairman, and endorsed "Tender for Coal," to be sent in not later than the 5th of June.

The Directors do not bind themselves to accept the lowest or any tender, and reserve to themselves the right to divide the contract between two or more firms.

By order,
T. E. STILLARD,
Secretary.

Gas-Works, Dudley,
May 16, 1894.

TENDERS FOR TAR.

THE Corporation of Walsall invite TENDERS from persons willing to purchase the surplus TAR made at the Pleck and Wolverhampton Street Gas-Works during One Year from the 1st of July next.

The Corporation will deliver it into the Contractor's Boats at the Gas-Works. Not more than two Boat Loads will be allowed to remain in the Tanks at each Gas-Works at any time.

The price per quantity of 210 gallons to be stated. To be paid for monthly.

Tenders, sealed and marked outside "Tender for Tar," are to be sent to me on or before Tuesday, the 29th of May inst.

Security will have to be given for the performance of the contract.

JOHN R. COOPER,
Town Clerk.

Borough Offices, Walsall,
May 17, 1894.

TO LIME MASTERS.

THE Corporation of Walsall invite TENDERS for the supply of about 800 tons of LIME, which will be required at their Gas-Works during One Year from the 1st of July next; the deliveries to be in such monthly quantities as the Manager of the Gas-Works may from time to time direct.

The Lime is to be hand-picked and clear from Refuse and Ashes, and to be delivered at Walsall Railway Stations as required.

Payments monthly.

Tenders, sealed and marked outside "Tenders for Lime," are to be sent to the undersigned on or before Tuesday, the 29th of May inst.

JOHN R. COOPER,
Town Clerk.

Borough Offices, Walsall,
May 17, 1894.

BOROUGH OF BURTON-UPON-TRENT.

TO COLLIERY PROPRIETORS.

THE Mayor, Aldermen, and Burgesses of the Borough of Burton-upon-Trent, acting by the Council, are prepared to receive TENDERS from Colliery Proprietors for the supply of 25,000 tons, or a portion thereof, of Best Screened GAS COAL, to be delivered, in Sender's or Railway Company's Trucks at the Gas-Works Railway Siding, Burton-upon-Trent, between the 1st day of July next and the 30th day of June, 1895.

The deliveries are to be made in such quantities and at such times as may be directed by the Manager.

Payment: Net Cash, Monthly.

Tenders, enclosed in an envelope, sealed and endorsed "Tender for Coal," are to be delivered to me at or before Ten a.m., on Thursday, the 24th of May inst.

The Council do not bind themselves to accept the lowest or any tender.

F. L. RAMSDEN,
Manager and Engineer.

Gas and Electric Light Works,
Burton-upon-Trent, May 4, 1894.

FAREHAM GAS AND COKE COMPANY.

THE Directors invite Tenders for the supply of 1200 to 1400 tons (more or less) of best fresh wrought GAS COAL, delivered by Water, and metered free into Carts at their Wharf at the Works, in such quantities as they shall from time to time require during the Year ending the 30th of June, 1895.

Quarterly settlements.

Tenders, specifying description and the Pits from which the Coal is to be supplied, to be sent in to me by Twelve o'clock on the 28th inst.

The lowest or any tender not necessarily accepted.

HARRY SMITH,
Secretary.

Gas-Works, Fareham, Hants.,
May 19, 1894.

TENDERS FOR GAS COAL.

THE Directors of the Victoria Newmarket Gaslight and Coke Company, Limited, invite TENDERS for the supply of 4500 tons of best screened GAS COAL during the ensuing Twelve Months ending June 30, 1895.

Tenders, stating price per ton, delivered free at Newmarket Station as required, to be sent to the undersigned on or before the 30th of May, 1894, from whom any further Particulars may be obtained.

The Directors do not bind themselves to accept the lowest or any tender.

By order,
J. H. TROUGHTON,
Manager and Secretary.

Gas-Works, Newmarket,
May 19, 1894.

SHREWSBURY GASLIGHT COMPANY.

DESIRABLE INVESTMENT.

THE Directors of the above Company invite TENDERS FOR £5000 SHREWSBURY GAS STOCK.

This Stock is entitled to a Maximum Dividend of 7½ per cent., payable half yearly; and the Maximum Dividend has been paid for many Years.

May 29, 1894, is the last day for the reception of tenders.

Forms of Tender, and any other Information, may be had on application to LLOYDS BANK, LIMITED, SHREWSBURY; or to

WILLIAM BELTON,
Secretary.

Gas-Works, Shrewsbury,
May 12, 1894.

GUILDFORD GASLIGHT AND COKE COMPANY.

TO TAR AND LIQUOR DISTILLERS.

THE Directors of the above Company are prepared to receive TENDERS for the surplus TAR and LIQUOR produced by the above Company for the Year ending June 30, 1895. Coal carbonized, about 10,000 tons per annum.

All tenders to state the price per cask of 40 gallons, and in matter of Liquor to state the price per degree Twaddel, from 5° upwards.

Cartage to and from Railway Station, Guildford, free. All empties to be provided by Contractor.

Tenders, endorsed "Tar" or "Liquor," to be sent to the Chairman of the Gas Company, Guildford, on or before Thursday, May 24, 1894.

By order,
WILLIAM LONGWORTH,
Secretary.

Gas Offices, Guildford,
May 14, 1894.

TENDERS FOR GAS COAL.

THE Directors of the Sunderland Gas Company are prepared to receive TENDERS for GAS COALS (in lots of 5000 tons and upwards), to be delivered by Rail on the Company's Sidings at Hendon or Ayre's Quay Gas-Works, in such Monthly proportions, from July 1, 1894, to June 30, 1895, as the make of Gas may render necessary.

The Coals to be Clean, Dry, and Fresh Worked.

Tenders, endorsed "Tender for Gas Coals," specifying the description of Coals, the name of the Pit and the particular Seam from which the Coal is to be supplied, to be left at the Offices of the Company, Borough Road, Sunderland, on or before Ten a.m., on Tuesday, May 29.

Short weight or inferior quality to be allowed for.

The Company do not bind themselves to accept the lowest or other tender until after a satisfactory trial of the Coals to which such tender may relate shall have been made.

J. H. COX,
Secretary and Manager.

Sunderland, May 19, 1894.

GLOUCESTER GASLIGHT COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the above Company invite TENDERS for the supply of about 20,000 tons of GAS COAL for One Year from the 1st day of July next, in such monthly quantities as may be required by the Company.

Tenders to state the price delivered at the Midland Railway Wharf, High Orchard, or the Great Western Railway Wharf, Llanthony, Gloucester; or if sent (as preferred) by water, the price f.o.b., and also the price delivered at the Gas Company's Wharf on the Gloucester and Berkeley Canal.

Further Particulars and Forms of Tender may be obtained of the Company's Engineer, Mr. R. Morland.

Sealed tenders, endorsed "Tender for Coal," specifying the description and quality of the Coal, to be addressed to the Chairman, Gas Offices, Eastgate Street, Gloucester, and delivered not later than Monday, the 11th day of June next.

The Directors reserve to themselves the right to accept the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any tender.

By order,
WILLIAM E. VINSON,
Secretary.

Gas Offices, Gloucester,
May 10, 1894.

FALKIRK JOINT-STOCK GAS COMPANY LIMITED.

TENDERS FOR COAL AND LIME.

THE Falkirk Joint-Stock Gas Company, Limited, invite TENDERS for COAL and LIME.

Estimated quantity 6500 tons of Splint or Cannel, 2500 tons of Shale, and 400 tons of Lime Shells, delivered, as required, at Dalderse Siding, Grahamston.

The Directors do not bind themselves to accept the lowest or any tender, and reserve the right to divide the contracts.

Sealed tenders, with analysis of Coal offered, to be sent in not later than Thursday, the 31st of May, 1894, addressed to the Manager, Gas-Works, Falkirk, and marked "Tender for Coal" or "Lime," as the case may be.

MANUFACTURE AND SUPPLY OF GAS AT SHOEBURYNESS.

THE Secretary of State for War is prepared to receive TENDERS for the Manufacture and Supply of GAS at Shoeburyness, during the period of Six Years, from the 1st of July, 1894.

The existing Gas-Works at Shoeburyness may be inspected on application to the Officer Commanding the Troops at that Station, and Printed Forms of Tender and any further Information obtained, on application to the General Officer Commanding the Troops, Chatham.

The tenders are to be delivered at the District Head Quarter Office, the Barracks, Chatham, by Twelve o'clock Noon, on Wednesday, the 13th day of June, 1894, addressed to the General Officer Commanding, and marked on the outside "Tender for Manufacture of Gas."

District Head Quarter Office, Chatham,
May 15, 1894.

ROCHDALE CORPORATION.

TO COLLIERY PROPRIETORS AND OTHERS.

THE Gas Committee of the above Corporation invite TENDERS for the supply of 40,000 tons of screened COAL or NUTS, to be delivered during a period of Twelve Months from the 1st of July next.

Tenders will be received for any portion of the above quantity, and must be sent in on the printed forms which may be obtained on application to Mr. T. Banbury Ball, the Manager at the Gas-Works.

Tenders, stating price per ton of 20 cwt., must be sent in to me, endorsed "Coal," not later than Noon, on Wednesday, the 30th of May, 1894.

By order,
ZACH. MELLOR,
Town Clerk.

Town Hall, Rochdale,
May 19, 1894.

SUTTON-IN-ASHFIELD LOCAL BOARD.

(GAS DEPARTMENT.)

TO TAR DISTILLERS AND OTHERS.

THE Gas Committee of the Sutton-in-Ashfield Local Board are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR produced at their Works from July 1, 1894, to June 30, 1895.

Particulars may be obtained on application to Mr. A. Clarke, Gas-Works, Sutton-in-Ashfield, Notts.

Tenders, stating price per ton of 20 cwt. at the Works, or at Sutton-in-Ashfield Railway Station, to be addressed to the Clerk to the Local Board, Local Board Offices, Sutton-in-Ashfield, and marked "Tender for Tar and Liquor," so as to arrive not later than Tuesday, the 29th day of May, 1894.

By order,
G. H. HIBBERT,
Clerk to the Committee.

Local Board Offices, Sutton-in-Ashfield, Notts.
May 10, 1894.

TENDERS FOR COALS.

THE Directors of the Isle of Thanet Gas Company invite TENDERS for the supply of 3500 tons of the best NEWCASTLE GAS COAL, to be delivered into the Company's Lift Waggon, at their Works at Margate, during the months of June, July, August, and September, in the following quantities (about):—

June	1000 tons.
July	1000 tons.
August	1000 tons.
September	500 tons.

Sealed tenders, endorsed "Coal," to be sent in on or before Thursday, May 24, addressed to the Chairman of the Company.

The Directors do not bind themselves to accept the lowest or any tender.

By order,
THOS. C. FULLER,
Secretary.

Gas-Works, Margate,
May 11, 1894.

ROCHESTER, CHATHAM, AND STROOD GASLIGHT COMPANY.

TAR AND AMMONIACAL LIQUOR.

THE Directors are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR to be produced at their Works at Rochester and Gillingham for One Year, commencing the 1st of July next.

The quantity of Tar will be about 303,000 gallons; of Liquor, about 960,000 gallons.

Further Particulars may be had on application at the Offices of the Company.

Tenders, marked "Tar" or "Liquor," are to be delivered to me at these Offices not later than Noon of Thursday, the 31st of May, 1894.

The Directors do not undertake to accept any tender; and security for due fulfilment of the contract must be given, if required.

J. M. VEEVERS,
Engineer and Secretary.

Gas Offices, Rochester,
May 17, 1894.

THE Directors of the Kildwick Parish Gas Company invite TENDERS for the supply of the whole or a part of 3000 tons of best screened GAS COAL or NUTS, to be delivered free at Kildwick, during the Twelve Months ending June 30, 1895.

The Coal to be delivered at such times and in such quantities as the Manager may direct.

Tenders to be sent in not later than June 1, 1894.

The lowest or any tender not necessarily accepted.

FRED. H. PICKLES,
Manager and Secretary.

Gas-Works, Kildwick,
May 9, 1894.

SCARBOROUGH GAS COMPANY.

THE Directors of the Scarborough Gas Company invite TENDERS for the surplus TAR and the whole of the AMMONIACAL LIQUOR produced at their Works, for One Year from the 1st of July next.

Tenders for Liquor may be submitted either at a fixed price per ton or on a sliding scale, regulated by the price of Sulphate. Preference will, however, be given to the latter.

Further Particulars may be obtained on application to the undersigned, to whom tenders (properly endorsed) must be delivered not later than Noon, on Tuesday, the 12th day of June next.

(Signed) J. HOLLIDAY,
Secretary and General Manager.

ST. ANNE'S-ON-THE-SEA GASLIGHT AND COKE COMPANY, LIMITED.

THE Directors of the above Company invite TENDERS for the construction and erection of the IRONWORK, &c., of a PURIFYING-HOUSE, PURIFIERS, VALVES, and CONNECTIONS at the Gas-Works, St. Anne's-on-the-Sea.

The Drawings and Specification may be seen at the Offices of the Engineer, Mr. Thomas Newbigging, C.E., 5, Norfolk Street, Manchester, from whom also copies of the Bill of Quantities and Forms of Tender may be obtained on deposit of Two Guineas, which will be returned on a *bond fide* tender being sent in.

Sealed tenders, endorsed "Contract No. 4, Tender for Purifying-House, &c.," to be sent so as to reach me not later than Saturday, the 2nd day of June, 1894.

The Directors do not bind themselves to accept the lowest or any tender.

WILLIAM H. NUTTER,
Manager and Secretary.

Gas Offices, St. Anne's-on-the-Sea,
May 18, 1894.

MONTE VIDEO GAS COMPANY, LIMITED.

NOTICE is Hereby Given, that the TWENTY-SECOND ORDINARY GENERAL MEETING of the Company will be held at No. 174, Winchester House, Old Broad Street, London, E.C., on Thursday, the 31st day of May, 1894, at Twelve o'clock Noon, to transact the General Business of the Company.

The Transfer Books will be closed from the 17th to be 31st of May inclusive.

By order,
A. G. HOUNSHAM,
Secretary.

Offices of the Company: 321, Dashwood House,
New Broad Street, London, E.C.,
May 16, 1894.

Fcap. 4to, Cloth, price 7s. 6d., post free.

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By
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(Wrought out of Holmside and South Moor Collieries.)

PRESENT production 4000 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16½ candles. The Sulphur is about 1 per cent., and the Ash 1½ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of nearly

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HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cubic feet.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

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Worked by THE HARTON COAL CO., LTD.

Output about 3000 tons per day.

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Yield of Gas per ton . .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
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COKE · · · · · · · 75 PER CENT.

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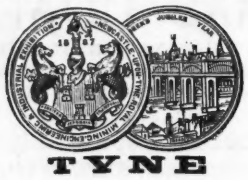

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The Analysis made by Messrs. J. and H. T. Pattinson, Public Analysts for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a Working Analysis made of these Coals by the Tudhoe and Sunderland Bridge Gas Company:—

[COPY.]

TUDHOE AND SUNDERLAND BRIDGE GAS COMPANY.
Tudhoe Gas-Works,
Spennymoor,
8th June, 1893.

Messrs. The
WEARDALE IRON & COAL COMPANY, LTD.

GENTLEMEN,

For the last two months we have used your **THORNLEY GAS COAL** exclusively at these gas-works; and I have pleasure in herewith giving you the actual results obtained during the trial.

Yield of Gas per ton: 10,300 cubic feet.
Yield of Coke: 13½ cwt.
Illuminating Power of Gas, average of a series of tests, **17 Sperm Candles.**
The Coke was of excellent quality.

The following is a complete ultimate Analysis of the Coal.

	Per Cent.
Carbon	83·128
Hydrogen	5·116
Oxygen	7·401
Nitrogen	0·585
Sulphur	0·620
Ash	3·130
Water	0·020
	100·000

Analysis of the Coke.

Carbon	93·31
Sulphur	0·61
Ash	5·00
Moisture	1·08
	100·00

I am, Gentlemen,
Yours truly,
A. B. COWAN,
Manager.

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Analysis: 12,600 feet of 19-candle gas per ton.
Weight of illuminating power in pounds of sprem, 820·80. Very free from impurities.
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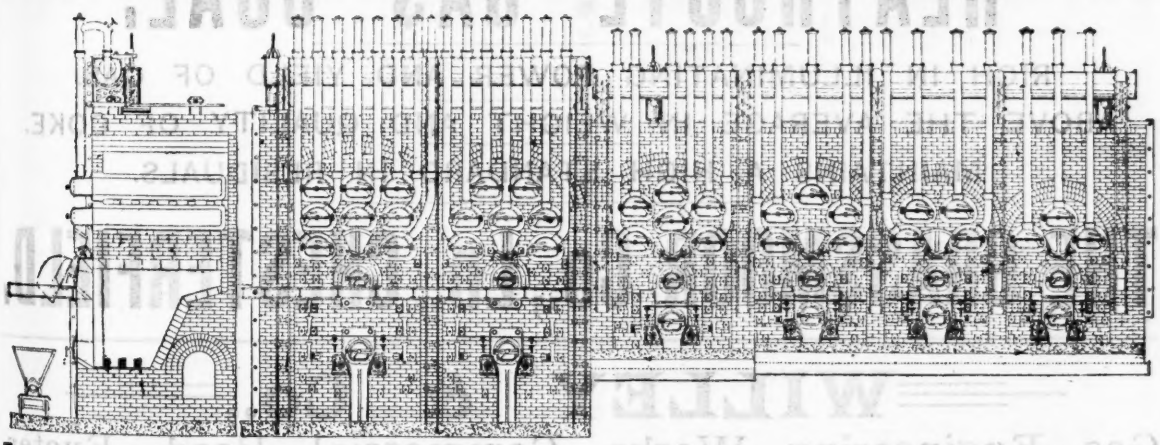

THESE SETTINGS ARE ADAPTED TO THE REQUIREMENTS OF ALL GAS COMPANIES AND GAS CORPORATIONS, AND HAVE ALREADY BEEN VERY EXTENSIVELY ADOPTED THEY ARE ERECTED UPON BOTH THE WORKING-STAGE AND SHALLOW-CHAMBER SYSTEMS AND EQUALLY SATISFACTORY RESULTS ARE GUARANTEED IN BOTH CASES. THE SETTINGS HAVE ATTAINED TO A MEASURE OF SUCCESS AND POPULARITY QUITE UNEQUALLED BY THAT OF ANY OTHER WITHIN THE SAME SPACE OF TIME. THE WORKING RESULTS OBTAINED, AND THE GENERAL SATISFACTION GIVEN, ARE DECLARED IN EVERY CASE TO EXCEED, AND IN MOST CASES CONSIDERABLY EXCEED, THE PATENTEE'S GUARANTEE. THE CONSTRUCTION AND WORKING OF THE PATENT PRODUCER AND THE PATENT CHARGING APPARATUS FOR SAME ARE ABSOLUTELY UNIQUE AND UNRIVALLED, AND ARE THE DELIGHT OF EVERY STOKER; WHILE IN EVERY OTHER PARTICULAR THEY SECURE THE HIGHEST RESULTS ATTAINABLE BY ANY REGENERATIVE SYSTEM, AND AT A MINIMUM OF COST.

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Further particulars may be obtained on application to the Patentee's Agents: C. M. HAMILTON, 5, Stuart Street, Shawlands, Glasgow; J. E. FISHER, Stourbridge; JOHN WALSH & SONS, Retort Builders, Halifax, Yorkshire; RICHARD TURNER, Retort Builder, Denton, Lancashire; and from the Principal Agent, R. F. HISLOP (son of Patentee), Gas-Works, Paisley, N.B.

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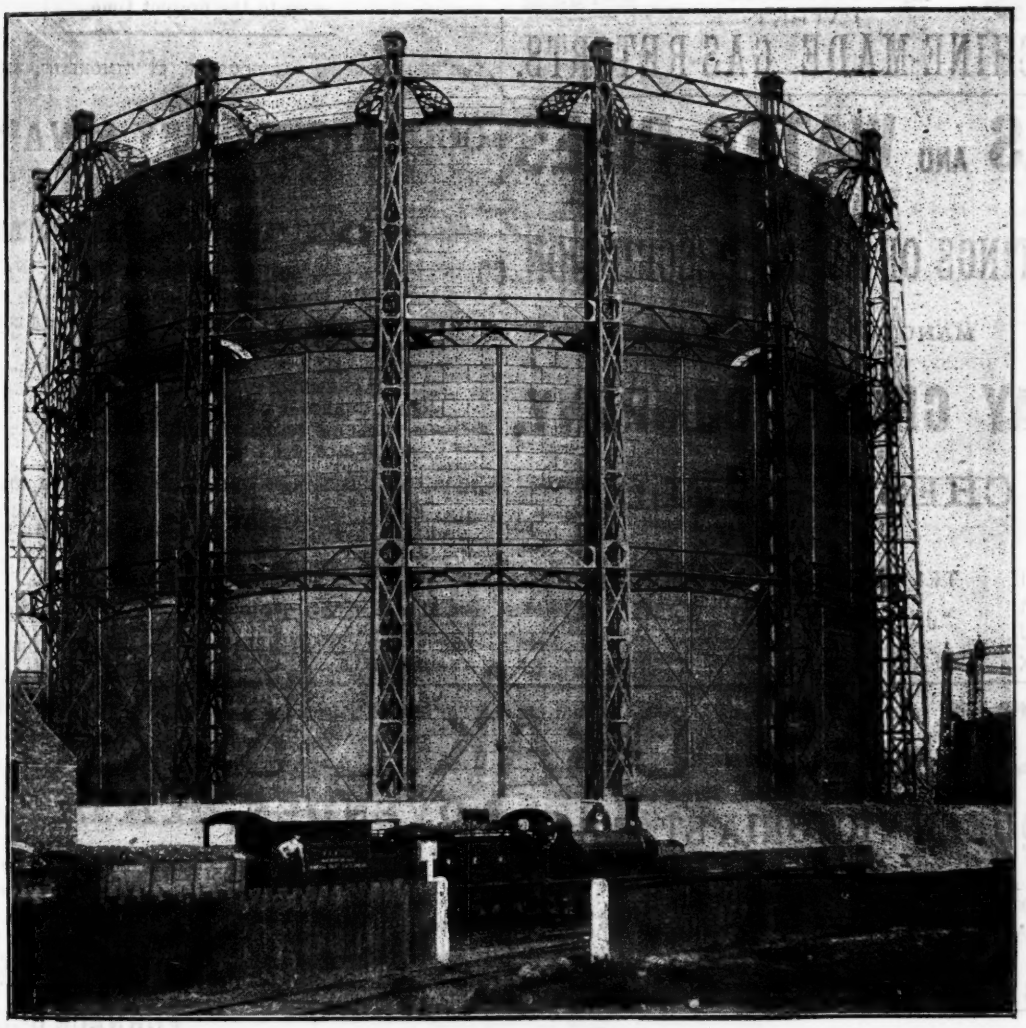

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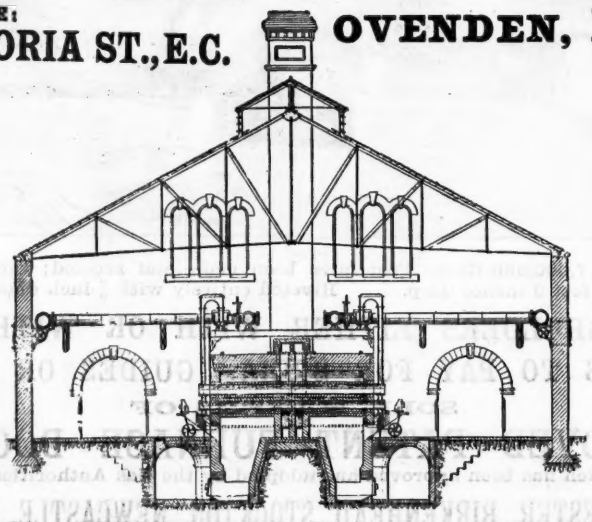

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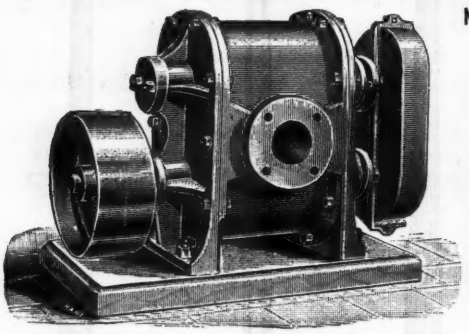

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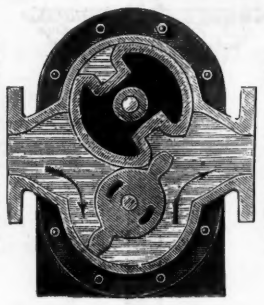

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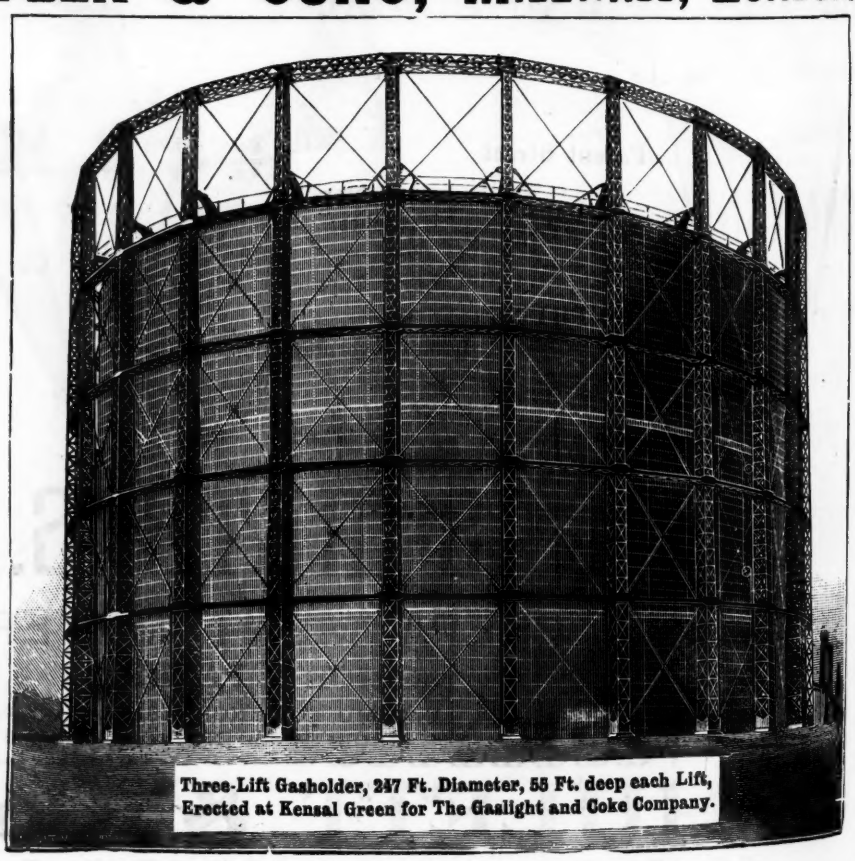

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